



THE RELATIONSHIP BETWEEN KEY SUPPLY CHAIN MANAGEMENT
PROCESS IMPLEMENTATION, COMPETITIVE ADVANTAGE AND
ORGANIZATIONAL PERFORMANCE

THESIS

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ORGANIZATIONAL PERFORMANCE

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THE RELATIONSHIP OF KEY SUPPLY CHAIN MANAGEMENT PROCESSES TO
COMPETITIVE ADVANTAGE AND ORGANIZATIONAL PERFORMANCE

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Abstract

In spite of an ever-accumulating body of research on the topic of supply chain management (SCM), an agreed upon definition or framework regarding its essential constructs or practices does not exist. There are, however, a few leading academic perspectives on SCM which have been bolstered by the acceptance of industry leaders. One such perspective is that as presented by the Global Supply Chain Forum (GSCF). Moreover, the scientific development of SCM as a comprehensive discipline has suffered from a lack of empirically validated models upon which advances in theory must be based. Likewise, this deficiency has hampered a complete understanding of SCM as well as the ability to prescribe actions for effectual implementation. This study applies established survey methods in order to expand the body of knowledge pertaining to SCM by empirically validating the relationships conceptualized by the GSCF framework through analysis of the perception of mid-level managers and senior level business executives from a variety of industries. Specifically, strategic implementation of three of the framework's eight SCM processes (i.e. customer service management, order fulfillment, and demand management) and their associated impact on both competitive advantage and organizational performance are measured.

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As the old proverb goes, “plans fail for lack of counsel, but many advisors bring success”. For me, this research endeavor has been a personal success and several advisors are deserving of acknowledgement. First, I received invaluable encouragement and guidance from my advisor, Dr. William Cunningham. His advising approach allowed me the latitude for a truly rewarding independent research effort and was the perfect capstone to my AFIT graduate experience. Additionally, Lieutenant Colonel Sharon Heilmann’s in-depth instruction on the research process as well as her instruction on the survey and analysis methods used in this study was nothing short of perfect. Major Daniel Mattioda also provided helpful advice and insightful feedback regarding the execution of the study and subsequent analysis. My appreciation also goes out to Mr. Terry Sampson, a true unsung hero. His expertise in formatting and distributing surveys was beyond helpful. I also appreciate the efforts of Ms. Jodi Tinney who helped facilitate the survey formatting and distributing process as well. Furthermore, this research endeavor would not have been nearly as enjoyable without the collaboration of my colleagues and classmates Captain John Perry and SMSgt Ron Salazar. Finally, I am always indebted to my family, whose love and admiration has always sustained my lofty ambitions.

Anthonelli White, Jr.

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I. Introduction

Background

As the nature and type of challenges faced by organizations shift with the times, business leaders constantly seek to stay abreast of leading edge management theories and practices in order to maintain the competitive advantage and performance of their organizations. Along with the process improvement theories of lean thinking and business process reengineering which emerged in the 1990s, the philosophy of supply chain management emerged as another potential avenue to the competitive edge sought by managers and leaders across the globe. Nonetheless, in spite of an ever-accumulating body of research on the topic of supply chain management, an agreed upon definition or framework regarding its essential constructs or practices does not exist (Bechtel & Jayaram, 1997; Chen & Paulraj, 2004; Croom, Romano, & Giannakis, 2000; Ho, Au, & Newton, 2002; Min & Mentzer, 2004). There are, however, a few leading academic perspectives on SCM which have been bolstered by the acceptance of industry leaders. One such perspective is that as presented by the Global Supply Chain Forum (GSCF).

In 1992, Dr. Douglas Lambert and others initiated the formation of a research center which would contribute significantly to the development, understanding and application of SCM. Originally called the International Center for Competitive Excellence, this group would later be renamed the Global Supply Chain Forum upon Dr. Lambert's move from the University of North Florida to The Ohio State University in 1994. The forum's aim was to develop a SCM framework which provided "structure to assist academics with their research on supply chain management and practitioners with

implementation” (Lambert, 2008). In 1994, the newly-formed GSCF developed its initial definition and corresponding framework on SCM. The finalized definition and framework were established a few years later in 1998 with inputs from 3M; CEMEX; The Coca-Cola Company; CSX Corporation; Fletcher-Challenge; Goodyear Tire and Rubber Company; Hewlett-Packard Company; Limited Distribution Services, Inc.; Lucent Technologies; McDonald’s; Texas Instruments, Inc.; Unilever HPC, USA; and Whirlpool Corporation (Lambert, Cooper, & Pagh 1998). Since then, the GSCF has been deeply involved in supply chain research as well as in degree programs and executive development programs around the world.

Problem Statement

As several recent researchers (e.g. Chen & Paulraj, 2004; Croom, Pietro, & Mihalis, 2000; Ho, Au & Newton, 2002; Min & Mentzer, 2004) have noted, the scientific development of SCM as a comprehensive discipline has suffered from a lack of empirically validated models upon which advances in theory must be based. Likewise, this deficiency has hampered a complete understanding of SCM as well as the ability to prescribe actions for effectual implementation. Herein lays the problem with the GSCF framework on SCM. Even as the GSCF has worked to bridge the gap between academia and industry by translating the theories advanced in research literature to viable practices and tools for business leaders, its framework has yet to be empirically validated. Initially, the framework was developed based on inputs and case studies of the supply chains of GSCF members. Additionally, using their prior research, the existing SCM literature as well as inputs from the GSCF members, 80 interviews were conducted with managers representing various levels, functions and processes across 11 companies

(Lambert, Cooper, & Pagh, 1998). However, measurement and analysis of the constructs outlined by the conceptual framework is necessary in order to refine SCM theory and enable effective SCM application and implementation.

Research Objectives & Questions

The objectives of this research were twofold. First, this research aimed to explore the relationships between the GSCF framework's constructs in order to inform attempts at business leader implementation of key processes at the strategic level. Second, it was the aim of this research to further the scientific development of SCM theory through empirical validation of the GSCF framework. Specifically, this research offered three research questions based on framework-specific literature as well as related literature from the body of SCM research. The corresponding hypotheses are discussed in Chapter II of this paper.

1. How does implementation of key SCM processes impact organizational performance?
2. How does implementation of key SCM processes impact competitive advantage?
3. What is the relationship between organizational performance and competitive advantage?

Methodology

The intent of this research was to use established survey methods and statistics to measure the relationships between degree of implementation of key SCM processes, organizational performance and competitive advantage. A web-based survey was developed and distributed to 800 key business leaders. The survey consisted of items which measured the perceptions of respondents in regard to their implementation of key

processes, and their firm's level of competitive advantage and performance as measured against the (perceived) industry average. Upon gathering respondent data, statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 18.

Assumptions/Limitations

This research made several key assumptions in order to limit the scope of the study and to facilitate data analysis. First, in execution of this research, only data regarding the management of key business processes was considered. For that reason, it was assumed that participating respondents and their firms had addressed the other two essential elements of the GSCF framework (i.e. supply chain network structure and supply chain management components). Along those lines, it was specifically assumed that respondents and their firms had an established corporate strategy. Another assumption was that individual respondents were able to accurately relate the nature of strategic-level trends within their respective firms. Lastly, to aid measurement of perceptions related to competitive advantage and organizational performance, it was assumed that individual respondents were able to make an accurate assessment of their firm's standing as compared to competitors within their industry.

In regard to limitations, this study was limited in scope in that it did not consider the relationships between—or effects on performance by—the elements of supply chain structure and management components. Even more, this research was limited by an unusually low response rate. Also, it should be noted that this study is one of three which looked at the GSCF framework. Only three of the eight processes are discussed here: customer service management (CSM), order fulfillment (OF), and demand management

(DM). Moreover, the framework is tested at the strategic level only and does not consider implementation of key processes at the operational level of business. Lastly, this research does not offer any insight into the differences or relative performance of the GSCF framework as compared to other frameworks discussed in the SCM literature.

Implications

The objectives of this research were to further the development of SCM theory through empirically validation of the GSCF framework. Due to the low response rate and inability to conduct meaningful statistical analysis, this research represents an initial effort to validate the framework. Subsequent research efforts will likely benefit from the survey instrument which was developed as well as the proposed model which can be used to guide future research endeavors.

II. Literature Review

Overview

This chapter begins with a discussion of the GSCF definition of SCM and the essential elements of its framework regarding SCM. Next, examples of past attempts to empirically validate other SCM frameworks are presented in order to set the stage for the proposed model and its associated hypotheses.

Furthermore, it should be noted that, in acknowledging the absence of an agreed-upon definition of SCM in existing literature, the first portion of this paper simplifies the literature review by not considering other definitions or frameworks of SCM. Since this study's aim is to validate the GSCF framework, the following review focuses solely on GSCF-specific literature. Other, pertinent literature pertaining to SCM will be discussed later, when considering the approach to validating the framework and the development of the validation model.

Defining Supply Chain Management

Today, the GSCF defines SCM as “the integration of key business processes from end-user through original suppliers that provides products, services, and information that add value for customers and other stakeholders” (Lambert, 2008; p. 2). This definition came as the result of an effort to both expand and re-conceptualize SCM by incorporating significant changes in the understanding of SCM as inferred from the then-existing literature as well as from the inputs of “leading edge practitioners”. Specifically, Cooper, Lambert, and Pagh (1997) offered that SCM was more than the integration of a firm’s logistics function with that of other internal and external functions. Instead, they

suggested a concept of SCM which takes a process-oriented view of work activities, thereby de-emphasizing the traditional, “stove-piped” functions within and between firms, and allowing for integration and coordination of all business processes (Figure 1).

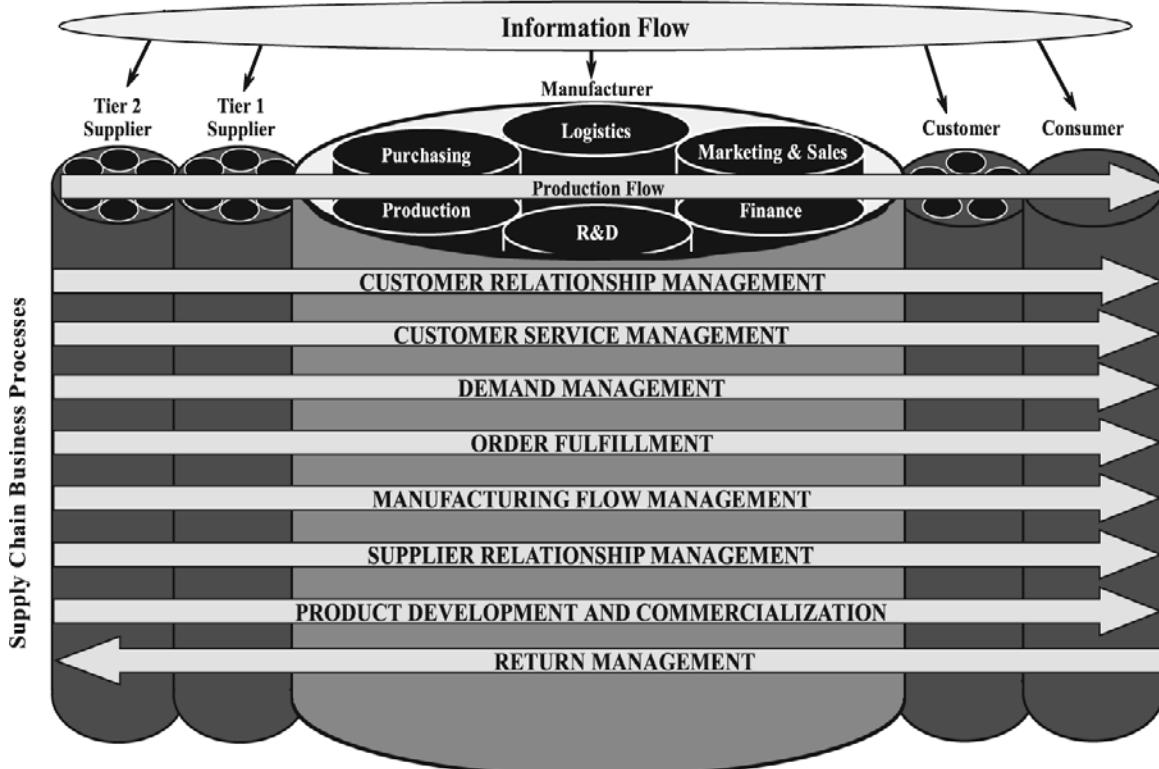


Figure 1. Global Supply Chain Forum Supply Chain Management Framework (Cooper et al. 1997).

Reviewing the rest of the existing SCM literature reveals many other attempts to accurately define exactly what is meant by SCM. As a matter of fact, the lack of a universally accepted definition and interpretation of SCM has been noted from the earliest discussions on the topic (Bechtel & Jayaram, 1997) all the way up to recent studies (Gibson, Mentzer, & Cook, 2005; Ho, Au & Newton, 2002). Croom, Romano,

and Giannakis (2000) identified the lack of an agreed-upon definition as one of the reasons for the incoherent nature of SCM research to date. Therefore, in order to focus the review of existing literature, this paper considers only GSCF-specific research as it pertains to the concepts identified by the framework.

The Three Essential Elements

Perhaps the single distinguishing characteristic of the GSCF framework is its unique focus on the need to integrate and manage multiple business processes across companies. This aspect of the framework goes beyond simple coordination between the logistics function and other functions internal to a particular firm or even across multiple firms. Rather, it encompasses all of the links and relationships between functions internal and external to a firm. As Lambert et al. (2008) posit in their book *Supply Chain Management: Processes, Partnerships, Performance*, “at the end of the day, supply chain management is about relationship management. A supply chain is managed link-by-link, relationship-by-relationship, and the organizations that manage these relationships best will win” (p. 6). Furthermore, the GSCF bases its framework on three critical inter-related elements of supply chain management (Figure 2): the structure of the supply chain, the supply chain business processes, and the supply chain management components (Lambert, Cooper, and Pagh, 1998).

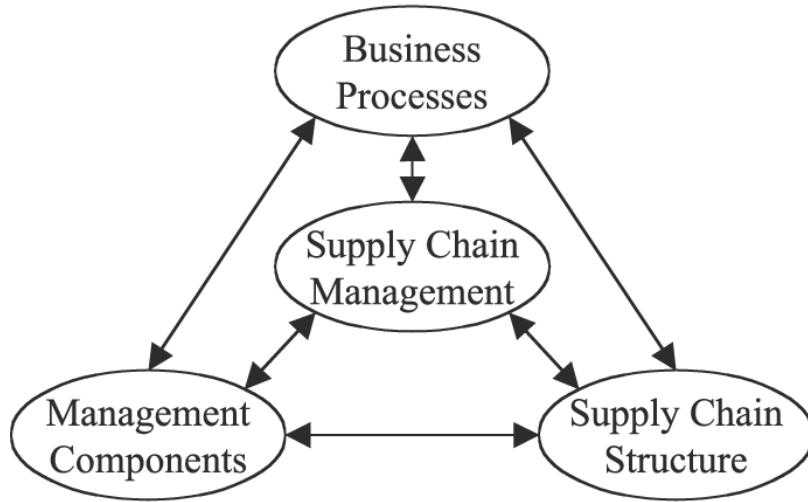


Figure 2. Supply Chain Management Components (Cooper, Lambert, & Pagh, 1998).

The first of these three elements addresses the network of members and the links between members of the supply chain. Decisions regarding the supply chain structure require managers to determine the key supply chain members with whom to link key business processes. The business processes element refers to the activities which produce a specific output of value to the customer. Decisions regarding business processes require managers to determine which processes should be linked with each of the key supply chain members. Lastly, the management component element of the framework refers to managerial variables by which business processes are integrated and managed across a given supply chain. Decisions regarding management components require business leaders to determine what level of integration and management should be applied for each process link. As discussed previously, this research is limited in scope due to its focus on the business process element of the framework. In the section that follows, the eight business processes will be presented with particular emphasis being

given to three in particular (customer service management, order fulfillment, and demand management).

Overview of the Eight Supply Chain Management Processes

As indicated in the GSCF definition of SCM and as briefly presented in the discussion regarding the three essential elements of SCM, integration of key business processes across a given supply chain is given special emphasis in the GSCF framework. This is noted as important for at least a couple of reasons. First, since businesses are often engaged in a variety of activities and relationships with other businesses, it is natural that some or all of their internal activities are linked together. This reality creates the possibility for one company's actions to not only affect the activities of its supply chain partners but also creates the possibility for that company's actions to ripple throughout the supply chain and thereby affect the activities of the end-customer. It follows, then, that the opportunity for enhanced performance in satisfying customer requirements lies in linking and managing internal key activities and business processes across multiple companies.

Secondly, process integration is necessary in order to synchronize supply chain activities and to avoid confusion in information flows. In their study, Lambert, Cooper, and Pagh (1998) found that companies within the same supply chain had different activity structures with some companies emphasizing a process structure while others emphasized a functional structure. Additionally, companies within the same supply chain were found to have different numbers of processes consisting of different activities and links between activities. Further increasing the confusion, companies within the same supply chain called similar activities by different names or, in some cases, different

activities by similar names. The identification of key business processes was offered as an essential element of the framework to assist practitioners in communicating and linking activities across firms.

Another distinguishing characteristic of the GSCF framework is that each of the key processes consists of both strategic and operational sub-processes designed from the perspective of a manufacturing firm sitting near the middle of the supply chain. In defining the idea of a process, the framework uses Davenport's definition: "a structured and measured set of activities designed to produce a specific output for a particular customer or market" (Lambert, Cooper, & Pagh, 1998). In general, the strategic sub-processes comprise the actions and decisions related to establishing the overarching strategy and structure through which each of the processes is to be executed. The operational sub-processes, however, encompass the day to day activities which bridge the gap between overall strategy and delivery of products and services in accordance with agreements made with customers. Moreover, each of the key processes extend out across the length of a given supply chain and permeate firms and traditional functional silos such as marketing, research and development, finance, production and purchasing and logistics (Croxton, Garcia-Dastugue, Lambert, and Rogers, 2001). The eight SCM processes identified by the GSCF framework along with their brief explanations are listed below.

- ❖ *Customer Service Management (CSM):* involves administering the agreements between a firm and its customers with specific focus on proactively intervening on the customer's behalf when problems arise in delivering on promises that have been made.

- ❖ *Demand Management (DM)*: involves the balancing of customer requirements with the capabilities of the supply chain through forecasting, reduction of demand variability as well as synchronization of supply and demand.
- ❖ *Order Fulfillment (OF)*: includes all activities necessary to design a delivery/logistics network and enable a firm to meet customer requirements while minimizing costs.
- ❖ *Returns Management (RM)*: consists of activities associated with managing the flow of returned products—to include returns mitigation and analysis—as well as reverse logistics.
- ❖ *Product Development and Commercialization (PD&C)*: involves actions to provide structure for developing and bringing to market new products jointly with customers and suppliers.
- ❖ *Manufacturing Flow Management (MFM)*: involves all activities necessary to obtain, implement and manage manufacturing flexibility in the supply chain and to move products through the plants.
- ❖ *Customer Relationship Management (CRM)*: involves actions to identify key customer segments and to determine the structure and methods to be employed in delivering products and services to customers.
- ❖ *Supplier Relationship Management (SRM)*: involves actions to provide the structure for how relationships with a firm's key suppliers will be developed and maintained.

In identifying these processes, Lambert, Cooper and Pagh (1998) acknowledged that the number of business processes critical and/or beneficial to integrate and manage between companies is likely to vary such that, in some cases, it may be appropriate to link one process while, in others, it is appropriate to link multiple or all key processes. This implies the need for business leaders to determine the need for and level of integration across the supply chain structure which is facilitated by the management components of the framework.

While very brief explanations have been provided for the eight SCM processes, what follows is a more in-depth—though still not comprehensive—discussion on the three processes with which this paper will later explore as they pertain to the validation of the GSCF framework. For further, in-depth readings on the GSCF framework and its processes, reference Lambert's *Supply Chain Management: Processes, Partnerships, Performance*.

Customer Service Management, Demand Management & Order Fulfillment: Strategic Sub-processes

Having already provided a brief overview of the eight processes, the three processes of interest to this particular research paper are now discussed. It should be noted that though each process consists of both strategic and operational sub-processes, this discussion is limited only to the strategic aspects of each process for the sake of both brevity and practicality.

The Customer Service Management Process

As Croxton, Garcia-Dastugue, Lambert and Rogers (2001) state, “the customer service management process is the firm’s face to the customer”. Through this process, a single point of contact and source of information are provided to the customer while product and service agreements (PSAs)—established as part of the CRM process—are proactively administered. At the strategic level, the CSM process has four sub-processes.

In the first strategic sub-process, a customer service management team develops the customer service strategy for the set of PSA features identified during the CRM process. Specifically, the CSM process team interfaces with the CRM process team to formulate a tiered customer service strategy. This strategy is intended to parallel the array of established PSAs in order to account for the importance of customers, customer requirements, and the firm’s capabilities and profit goals. Additionally, the team identifies the deliverables of the CSM process; identifies potential events which may arise while executing PSAs; operationalizes the triggers and signals for initiating action; and defines staffing, administrative and technological resources needed for executing the customer service strategy.

With potential “customer service events” having been identified, the CSM process team sets out to identify which events require responses and to develop standardized response procedures for those events. For this sub-process, the primary goal is to establish guidelines which trigger customer service events and an appropriate response with enough time to resolve situations prior to customers being affected.

In the third sub-process, the CSM process team identifies the necessary infrastructure for implementing the response procedures developed in the second sub-

process. This includes identifying the sources of information needed to handle each event as well as appropriate communication protocols for internal and external coordination. The CSM process team then determines the information technology and communication needs such that the systems used are able to identify problems associated with delivering on promises made in the PSAs. If technical constraints arise, the CSM team works with the CRM process team in order to re-evaluate and, if necessary, modify components of affected PSAs.

Finally, in the fourth sub-process, the CSM process team develops the framework of metrics to be used in measuring the performance of the process and sets goals for performance improvement. Metrics developed for the CSM process are developed with input from the CRM process team to ensure they are consistent with the firm's objectives and reflect the customer's expectations. Ultimately, CSM process metrics should reflect the impact of CSM on the organization's efficiency and financial performance.

The Demand Management Process

The DM process, according to the GSCF framework, represents the set of activities a firm takes in order to balance customer requirements with the capabilities of the supply chain in the most efficient way. This process goes beyond forecasting endeavors and includes synchronization of demand with production, procurement and distribution. Even more, it addresses management practices which increase variability and seeks to introduce policies which foster smooth demand patterns while also planning for possible contingencies. At the strategic level, the DM process has six sub-processes.

As with all of the other key processes, the DM process begins with a review of overall corporate strategy as well as customers and their requirements. Additionally the

process team must have a deep understanding of the firm's manufacturing capabilities as well as the capabilities of the supply chain network. This may require communication with the CRM, SRM and/or MFM process teams. In the end, the team must establish the goals and focus of the process.

Next, the team determines the forecasting procedures necessary for achieving firm strategy and goals. This includes setting the levels and time frames of the forecasts needed throughout the firm, identifying the sources of data and defining forecasting procedures for each forecast required. Particular attention is given to coordinating forecasts across functions and firms as necessary to ensure all planning by managers is accomplished using the same information (e.g. collaborative planning, forecasting and replenishment or Vendor Managed Inventory).

In the third sub-process, the DM team plans the flow of information. This includes specification of how input data will be transferred, and what output needs to be communicated internally and across the supply chain. These efforts may require development or enhancement of information systems in order to facilitate smooth, uninterrupted transfer of information. Once the flow of information is established, the process team determines the synchronization required to match the demand forecast to the supply chain's manufacturing, supply and logistics capabilities. These activities represent the fourth strategic sub-process.

Once the main components of the DM process have been addressed, the team seeks to develop contingency plans to respond to significant internal or external events which could potentially disrupt the balance of supply and demand. This includes both interruptions to supply and unexpected customer requirements. Contingency planning

efforts are coordinated with the CSM team, among others, as they are responsible for addressing customer concerns when unexpected issues arise. Finally, the DM process concludes with the development of a framework of metrics which measure performance of the process and inform process improvement efforts.

The Order Fulfillment Process

The GSCF framework acknowledges that the “key to effective supply chain management is to meet customer requirements in terms of order fulfillment” (Croxton, Garcia-Dastugue, Lambert and Rogers, 2001). Specifically, the OF process involves efforts to integrate a firm’s manufacturing, logistics and marketing plans as well as the inputs of key members of the supply chain. Moreover, the framework emphasizes that the process comprises more than just filling orders. Rather, the OF process is about “designing a network and a process that permits a firm to meet customer requests while minimizing the total delivered costs” (Lambert, 2008). These actions are accomplished through five strategic sub-processes.

First, the OF process team reviews the role of customer service in the firm’s marketing strategy and existing customer service goals as well as the supply chain structure. This is accomplished in order to design an OF process which is customer-focused but also operates within the limits of the firm’s business and marketing strategy. In this sub-process, the OF team determines how much is acceptable to spend on fulfilling customer orders by balancing the costs of order fulfillment solutions, the associated benefits to the customer, and the impact on the financial performance of the firm, its customers and suppliers. The team also considers existing sourcing and

distribution networks and how costs accumulate as product moves through the supply chain.

Next, the team works to define the requirements of the order fulfillment process. In this sub-process, the team reviews the order-to-cash cycle, defines lead-times, and seeks to understand customer service requirements as well as supply capabilities. The team also seeks to clarify the operational requirements of the OF process such as how many orders need to be filled per day, the number of loading docks required in order to process deliveries/shipments as well as any legal requirements for hazardous materials or customs requirements for international shipments. For some firms, the OF process may represent an opportunity to evaluate how core competencies within order fulfillment can be leveraged to enable potential service-differentiating capabilities.

In the third sub-process, the OF process team evaluates the logistics network. In particular, the team evaluates the supply chain network to determine which plants produce which products; where warehouses, plants, and suppliers are located; and which transportation modes should be used. Moreover, considerations made along these lines are informed by inputs from the DM and RM processes resulting in a network which is provided to the MFM process.

Following an evaluation of the logistics network, the OF process team defines the plan for order fulfillment, thereby determining how orders from various customers or segments of customers will be taken and filled and—with input from the DM process—what actions are taken when the order cannot be filled. This includes management decisions regarding information flows between OF and DM, payment terms, orders sizes, as well as picking and packing operations. Finally, as with all of the key processes, the

OF process concludes with the team developing measures of performance which will be used to monitor the process and its effect on the financial performance of the firm.

The Objective

While consensus regarding the scope of SCM as a discipline has not been achieved, a review of extant literature suggests that there is general agreement regarding the objective and potential benefits of implementing SCM practices. Specifically, implementation of SCM practices and concepts has been linked to enhanced competitive advantage and/or firm performance. The GSCF framework is no different in its claims. According to the GSCF, the objective of SCM is “to maximize competitiveness and profitability for the company as well as the whole supply chain network including the end-customer” (Lambert, Cooper, & Pagh, 1998).

It should be noted, however, that contributors to SCM literature have defined and operationalized competitive advantage and organizational performance in different ways. In the case of the GSCF-specific literature, for example, competitive advantage is mentioned as an objective and benefit of SCM however, it is not well defined. On the other hand, the GSCF framework is fairly clear as to what is meant by performance. In particular, the framework suggests each of the key processes be linked to specific metrics which are then linked to the overall profitability of the firm, its customers as well as supply chain partners. To measure the profitability associated with a particular process, the framework employs the use of an economic value-added (EVA) model as the preferred method of capturing a firm’s financial performance (Figure 3).

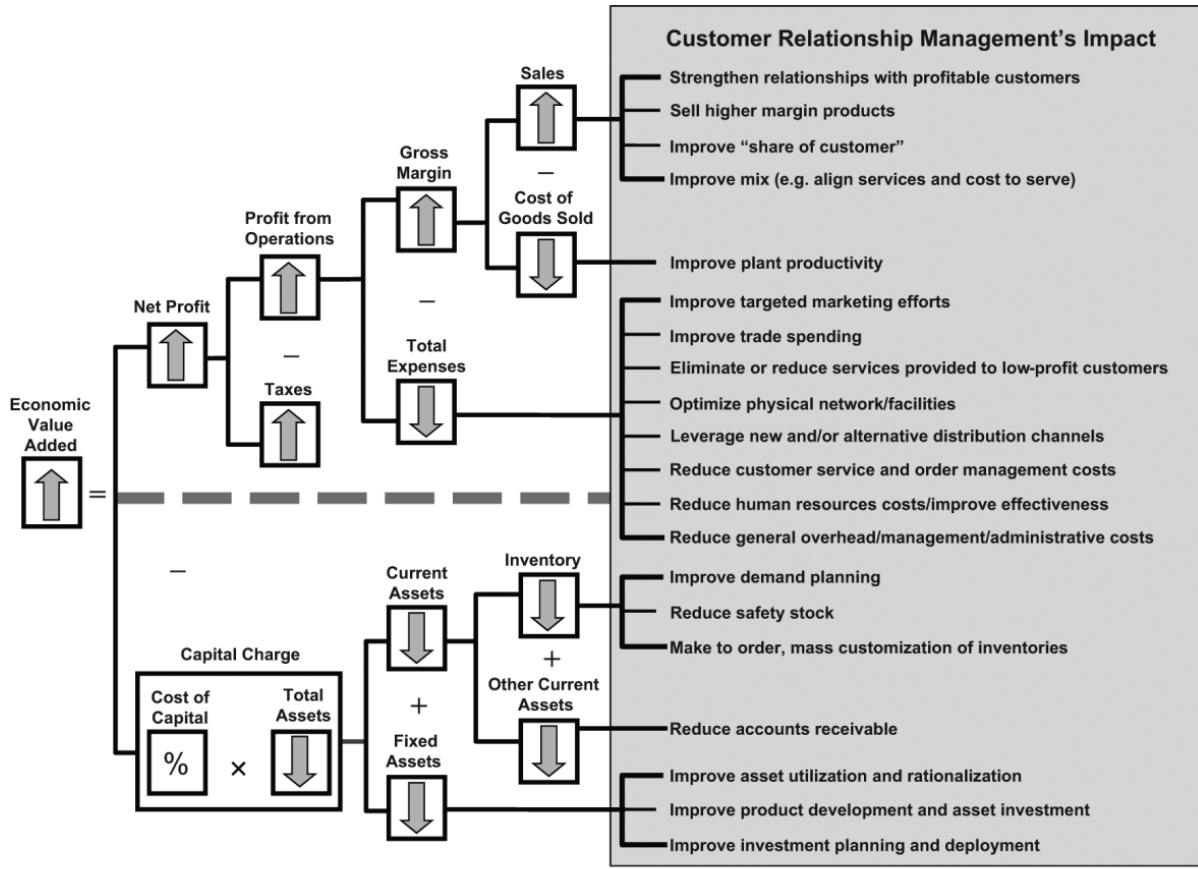


Figure 3. Economic Value-Added Model (Lambert, 2008).

Unlike some other methods of capturing firm financial performance, the EVA model explicitly accounts for the costs associated with capital employed in execution of business processes.

Empirical Validation of SCM Frameworks

The concepts and ideas which comprise the domain of SCM originated in logistics literature (Bowersox, Carter & Monczka, 1985; Jones, Thomas, & Riley, 1985; Houlihan, 1985; Martin, 1994). Since those early attempts to shape the SCM discipline, there have been many contributions in terms of the conceptual underpinnings of SCM. Not too long after the initial discussions on SCM, Bechtel and Jayaram (1997) noted in their critical review of SCM literature the fragmented nature of its contributions. They

also noted the importance of building on the SCM concepts of the time and moving toward formation of theories which could be empirically tested. This, they stated, would be the essential element in keeping SCM from becoming diluted and irrelevant as a discipline.

Similarly, in their review of SCM literature, Croom, Romano and Giannakis (2000) echoed the sentiments of Bechtel and Jayaram and themselves noted the “relatively poor supply of empirically validated models explaining the scope and form of supply chain management, its costs and its benefits” (p. 69). In response to these and other calls for increased theory building and empirical validation of models, a number of studies have been conducted to better define SCM. In the literature reviewed for this study, some studies were found which sought to report SCM best practices while several attempted to propose and test normative models.

In a 1998 study, Spekman, Kamauff, and Myhr executed an empirical study of SCM from the perspective of partnerships. Particularly, the study surveyed operations/procurement managers and marketing managers across a set of firms comprising a supply chain in order to capture attitudes and perceptions regarding collaborative supply chain practices. The study represented the responses of 22 aggregate supply chains from North America, South America and Europe across five broad industry groupings (life sciences, oil and gas, consumer products, utilities and manufacturing—high-tech electronics and automotive). Ultimately, respondent data was linked to two measures of performance—customer satisfaction and cost reduction. By way of descriptive statistics and regression analysis, the study found links between the level of collaboration between buyers and sellers and firm performance.

Posing relationships between SCM practices, supplier performance and company performance, Tan, Kannan, and Handfield (1998) employed a survey to collect information on how companies manage three components of SCM: purchasing, quality management and customer relations. The survey population consisted of members of the American Society for Quality Control (ASQC) from which 1,469 manufacturing firms from a broad spectrum of industries were identified. In all, 313 responses were received. Survey respondents consisted of quality directors and vice-presidents of the companies. Using bivariate correlation analysis, the researchers investigated whether SCM had an impact on firm performance using nine measures (i.e. market share, return on assets, market share growth, sales growth, production costs, customer service, product quality and competitive position). From the study, literature suggesting customer relations and purchasing practices could impact the effectiveness of SCM strategy and a firm's financial performance was supported.

In a similar study, Vickery, Calantone and Droke (1999) suggested a firm's ability to perform in the face of uncertainty as the essence of SCM and a critical determinant of firm success. In their study, they surveyed chief executive officers of strategic business units, autonomous divisions and individual firms in the office and residential furniture industry whose sales revenues exceeded \$1 million. Using correlation analysis and a sample of 65 respondents, a significant positive relationship between supply chain flexibility and firm performance was found. Moreover, firm performance was measured using respondents' subjective assessments of their firm's performance along six indicators: return on investment, growth of return on investment, market share, market share growth, return on sales, and return on sales growth.

Based on literature and interviews of practitioners, Tan's (2002) exploratory study took 25 commonly-cited SCM practices as well as 9 commonly-cited barriers to SCM implementation and measured their relationship to firm performance. Firm performance was operationalized by senior management's perceptions of their firm's performance in comparison to that of major competitors and was measured along the lines of product quality, competitive position and customer service levels. A survey questionnaire was designed and distributed to some 3,000 supply and material managers from APICS, and 1,500 supply and materials managers identified from the Institute of Supply Management (ISM) memberships lists. In all, 411 usable surveys were received. Analysis consisted of bivariate correlation of SCM practices and concerns vis-à-vis performance. A positive relationship between SCM practices and performance was found as well as a negative relationship between concerns and performance. Exploratory factor analysis was applied and resulted in the SCM practices being reduced from 25 to 6 and supply chain concerns being reduced from 9 to 3. Multiple regression analysis was then applied and suggested three of the factors relating to SCM practices—supply chain integration, information sharing, and just-in-time capability—had a positive impact on a firm's competitive position.

Wisner (2003) hypothesized three components of SCM based on his review of SCM literature—supplier management strategy, customer relationship management strategy and SCM strategy—and investigated their linkages to firm performance. Firm performance was measured using six indicators: market share, return on assets, overall product quality, overall competitive position and overall customer service. To examine the expected relationships, Wisner applied structural equation modeling along with the

responses of 350 senior managers taken from the APICS and ISM member lists. The sample represented manufacturing and services firms from North America and Europe. In the end, a bi-directional relationship was found to exist between supplier and customer relationship management strategies. Additionally, both supplier management and customer relationship strategy were found to positively impact supply chain management strategy, which in turn, was found to influence firm performance.

Min and Mentzer (2004) built on their previous work by building scales to measure what they called “supply chain orientation” (SCO). Whereas SCO represented the degree to which a firm embraced the SCM philosophy, SCM was conceptualized as the efforts taken across multiple firms with a SCO to manage their supply chain. To test the nomological validity of their SCO and SCM constructs, Min and Mentzer (2004) created a business performance scale which consisted of a firm’s growth, availability, product and services offerings, timeliness and profitability. Data was gathered by distributing a survey questionnaire to 1,368 senior managers identified by the Council of Logistics Management membership roster. In all, 442 usable responses were received. Structural equation modeling was then used to establish nomological validity of the hypothesized “SCO-SCM-business performance path” and a positive relationship was found to exist between SCO and SCM as well as between SCM and business performance.

In one of the most recent and widely-cited articles in supply chain management literature, Chen and Paulraj (2003) developed a set of key SCM constructs based on their review and synthesis of over 400 articles. Furthermore, through an iterative process of refinement, they also produced a set of reliable, valid and unidimensional measures.

Their measures were developed for use across a variety of contexts in order to refine or extend conceptualizations of SCM as well as to test various theoretical models thereby paving the way for theory building in SCM. Similar to other research, their study was based on a questionnaire which measured SCM constructs. The questionnaire was distributed to senior management members of the ISM resulting in a sample size of 221 respondents. In the end, the focus of this study was more along the lines of establishing a rigorously-validated instrument as opposed to hypothesis testing. That said key SCM constructs were expected to be linked to supplier performance, buyer performance and buyer financial performance. Correlation analysis showed that most of the factors were correlated with positive performance.

Suhong Li, Bhanu Ragu-Nathan, T.S. Ragu-Nathan, and S. Subba Rao (2004) aimed to contribute to SCM theory with their own framework which hypothesized a link between SCM practices mentioned in literature, competitive advantage and organizational performance. Specifically, high levels of SCM practice were expected to be positively related to competitive advantage. Likewise, high levels of SCM practices were expected to be positively related to organizational performance. Additionally, high levels of competitive advantage were expected to be related to high levels of organizational performance. Of all the studies reviewed, this study was the only one which explicitly measured competitive advantage. In the study, competitive advantage was said to comprise a firm's ability to compete on the basis of price/cost, delivery dependability, product innovation and time to market. In terms of the organizational performance construct, this study used seven indicators: market share, return on investment, growth of return on investment, growth of market share, growth of sales,

profit margin on sales, and overall competitive position. Data for the study was gathered from 196 executive-level respondents using a survey questionnaire sent to members of the CLM or Society of Manufacturing Engineers. Applying structural equation modeling techniques, their study rendered support for all three hypotheses.

In summary, there have been considerable efforts to empirically validate SCM theories by relating some conceptualization of SCM practices to measures of performance. Moreover, these studies present ample examples and precedence for the research with which this study is concerned. Next, the proposed empirical model and the associated hypotheses are presented.

Proposed Model for Empirical Validation

Based on the GSCF-specific literature as well as applicable SCM literature, a research model for empirical validation of the GSCF framework was developed (Figure 4).

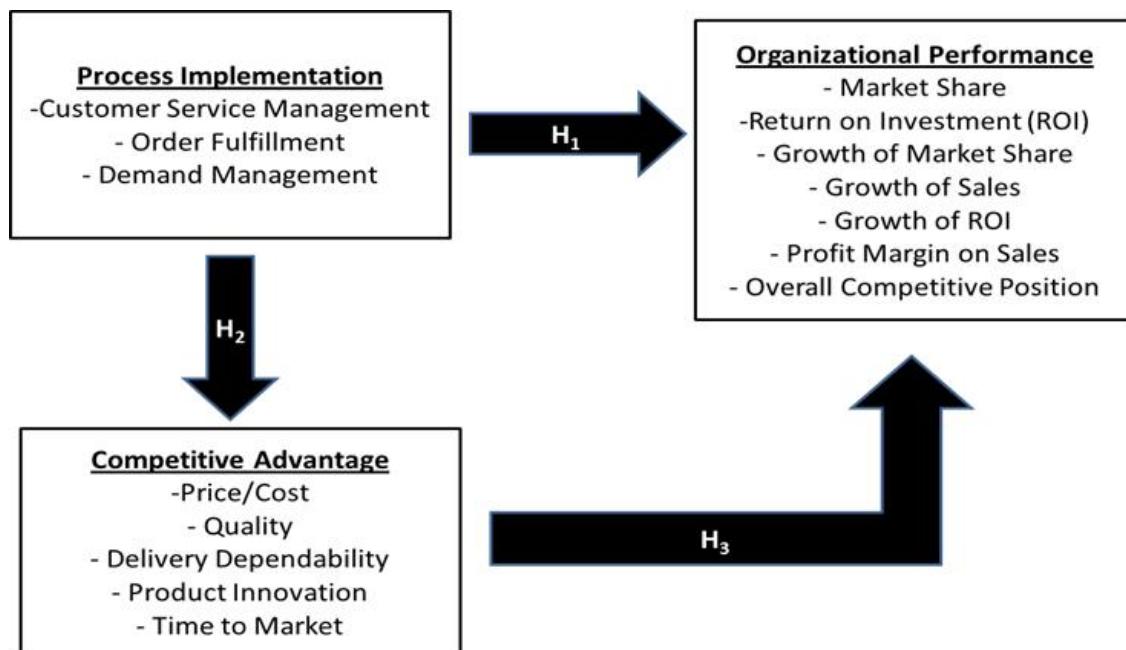


Figure 4. Proposed Validation Model.

Process Implementation

The hypothesized model begins with the key processes identified (i.e. CSM, OF, and DM) and defined in the GSCF-specific literature. Implementation of the respective processes is necessary to integrate the operations of businesses in order to effectively and efficiently satisfy customer requirements. Process implementation is to be operationalized by scales which require respondents to indicate the degree to which they agree with statements representing implementation of strategic sub-processes outlined by the framework. Accordingly, higher scores on process scales represent more robust implementation of key processes.

Organizational Performance

Again, as key processes are implemented, the resulting integration and coordination across internal functional areas and across organizations is expected to enhance a firm's ability to satisfy customer requirements. The GSCF-specific literature as well as validation of other SCM frameworks suggests implementation of SCM practices/processes is related to organizational performance (OP). Therefore, the following hypothesis is presented:

- ❖ Hypothesis 1: High levels of SCM process implementation are associated with high levels of organizational performance for all three processes

It should be noted that the proposed model deviates from the GSCF-specific literature in that organizational performance is not measured using EVA. First, scales for measuring EVA were not readily available in the literature. Additionally, developing

such scales would prove troublesome and impractical for statistical analysis. As Christopher and Ryals (1999) noted:

EVA is difficult to calculate, and more difficult to compare among companies and business units than ROI or ROE measures. The reason for this is that EVA is calculated by reference to the true cost of total capital employed. Accurate measures of net assets and the cost of capital are notoriously difficult to come by...EVA has also been challenged on the grounds that it does not actually explain the growth in market value of companies much better than the traditional earnings approach. (p. 2-3)

This explains the absence of EVA as a significant factor in any of the empirical studies reviewed and supports the use of more traditional factors. Since the study by Li et al. (2004) employed a similar research approach as the research at hand, especially in the conceptualization of and linkages between performance and competitive advantage, this study employs the same definition and uses the same scales to measure performance. In their study, Li et al. (2004) define firm performance (organizational performance) as “how well an organization achieves its market-oriented goals as well as its financial goals” (p. 111). Similar to other studies, performance is based on seven traditional elements: market share, return on investment, growth of return on investment, growth of market share, growth of sales, profit margin on sales, and overall competitive position. Organizational performance is, therefore, operationalized by the respondent’s agreement or disagreement with statements related to achievement of traditional financial/market performance measures. As such, higher levels of agreeable responses to the items on the scale are expected to indicate higher levels of organizational performance.

Competitive Advantage

Once a firm integrates processes across functional silos and with supply chain partners, implementation of key processes is expected to create/enhance the competitive advantage (CA) of the firm. This relationship is implied throughout the literature though it has been operationalized differently in various studies. Therefore, the following hypothesis is presented:

- ❖ Hypothesis 2: High levels of SCM process implementation are associated with high levels of competitive advantage for all three processes

Furthermore, as the GSCF framework does not specifically define competitive advantage, and since few validated scales for the construct exist in the literature reviewed, the definition and scale as presented by Li et al. (2004) is adopted. In their study, competitive advantage is defined according to Porter's typology. According to Porter (1985), in the long-term, the extent to which a firm is able to create a defensible position in an industry is a major determinant of the success with which it will outperform its competitors (Yamin, Gunasekaran, & Mavondo, 1999). Additionally, Porter proposed three generic strategies by which a firm could develop a competitive advantage and create a defensible position: overall cost leadership, differentiation and focus. This conceptualization of competitive advantage is closely mirrored by Li et al. (2004) where competitive advantage in their study is said to be based on a firm's ability to compete based on price/cost, quality, delivery dependability, product innovation and time to market. Competitive advantage, then, is operationalized in this study by the degree to which respondents agree with scale items representing possession of certain competitive

attributes by a firm as compared to its competitors. That said, as individual respondent agreement to scale items increase, so increases the expected competitive edge possessed by the respondent's firm. Based on established SCM literature, it is expected that as a firm creates a defensible position over its competition its performance will subsequently increase. Therefore, the following hypothesis is offered:

- ❖ Hypothesis 3: High levels of competitive advantage are associated with high levels of organizational performance

III. Methodology

Overview

In line with prior research in SCM literature, empirical validation of the GSCF framework was based on the administration of a 163-question questionnaire designed to gather perceptions of mid-level and executive-level managers regarding SCM processes, competitive advantage and organizational performance. Consisting of three sections, the survey was designed to measure the degree to which key SCM processes defined by the GSCF framework were implemented within a given firm. In the second section, managerial perceptions regarding the standing of their firm with regard to key indicators of competitive advantage as well as firm performance were measured. Finally, in the third section items were included to gather characteristics of individual respondents as well as the respondent's firm so as to facilitate comparative analysis. The following discussion details the process of creating, validating and administering the questionnaire.

Instrument Development

Development of the instrument used in this study depended heavily on established literature specific to the GSCF framework, but also incorporated elements of the SCM studies discussed in the literature review. Additionally, the assessment tool established by Lambert et al. (2008) for evaluating implementation of SCM processes in practitioner firms was used to guide item-generation for the respective process scales. The survey instrument and accompanying participation invitation are presented in Appendix A.

In the first section, items comprising the three individual process scales were designed to parallel the strategic sub-processes outlined by the framework. Specifically,

respondents were asked to indicate the degree to which they agreed with various statements pertaining to their firm's implementation of various elements of the framework and, in particular, key steps of the respective processes as defined in the GSCF framework. For clarity, respondents were asked to answer all questions from the perspective of their firm which was defined as their immediate strategic business unit. Also, one key assumption made in development of the process implementation scales was that the firms to which respondent's belonged had established some overarching corporate strategy. As each process begins with the strategic sub-process of reviewing corporate strategy and, in most cases, connecting the strategy formulated for the process to the overarching corporate strategy, this assumption was considered necessary to limit the length of the questionnaire.

In the second section of the survey, items comprising the organizational performance scale and competitive advantage scale were designed to measure respondents' perceptions of their firm's level of achievement in these areas. As previously discussed, the scales used to operationalize and measure competitive advantage and organizational performance were taken from the 2004 study by Suhong Li, Bhanu Ragu-Nathan, T.S. Ragu-Nathan and S. Subba Rao. For this section of the questionnaire, respondents were asked to indicate the degree to which they agreed with statements regarding five indicators of competitive advantage (price/cost, quality, delivery dependability, product innovation and time to market) and seven indicators of organizational performance (market share, return on investment, growth of return on investment, growth of market share, growth of sales, profit margin on sales, and overall competitive position).

In the last section of the questionnaire, items were generated in order to form profile data for the sample to enable comparative analysis. In particular, respondents were asked to provide information regarding individual expertise, experience and job title. Additionally, items were included to gather data regarding the respondent's firm such as volume of sales, number of employees and industry. Though no standard exists regarding the categories used for individual respondent as well as firm data, the categories used reflected similar categories used throughout SCM research.

Data Collection Procedures

Given the strategic focus of this study, mid-level managers and executive-level business leaders were deemed the ideal respondent population. That said, 800 potential participants were identified from the Council of Supply Chain Management Professionals mailing list. Once the questionnaire was reviewed and pilot-tested, it was converted into a web-based format and invitations to participate in the research were sent via email to the individuals on the distribution list. The survey was open for responses from December 19th, 2011 to February 8th, 2012. Reminders were sent approximately every one and a half weeks to respondents which had not completed the survey. Overall, ten respondents took part in the survey though only eight of the ten responses were complete and usable. Specifically, respondent #1 failed to complete the survey and respondent #10 provided neutral responses to almost all of the items. Responses from these two participants were removed from the data set thus resulting in an overall response rate of one percent (8/800). An analysis of the responses to the items comprising the individual and company profile section of the survey yielded the necessary demographics of the survey participants discussed in the following section.

Participants

Data regarding the study's participants was gathered through a total of seven items pertaining to the profile of the individual respondent as well as the respondent's firm. The following sections discuss characteristics of the eight survey respondents and their respective organizations.

Individual Profile

Respondents were asked to provide responses to four items pertaining to their individual profile. A brief description of the respective items follows.

Job Title. Survey respondents consisted of individuals holding positions ranging from mid-level managers up to executive level business leaders. In the individual profile sub-section, survey respondents were asked to indicate their current job title and were provided with the options of “CEO/President/Vice President”, “Director”, “Manager” and “Other”. Of the eight respondents, the reported job titles appeared to be almost equally distributed among the given categories with three respondents indicating positions of CEO/President/Vice President (37.5%), two respondents indicating the position of Director (25%) and three respondents indicating a Manager position (37.5%). The specific job titles reported included: Logistics Development Manager, Global Supply Chain Manager, Vice President (VP) Distribution & Fulfillment, Transportation Manager, VP of Supply Chain Management, Production Manager, Director of Supply Chain Initiatives, and VP of Global Manufacturing Alliances.

Years Worked in Current Position. The next item of the individual profile section asked respondents to indicate the number of years worked in their current position. The provided ranges for responses included less than 2 years, 2 to 5 years, 6 to 10 years and

greater than 10 years. All respondents indicated having worked in their current position for less than 10 years. Three (37.5%) of the eight respondents indicated having worked in their current position for less than 2 years while another three respondents (37.5%) indicated 2 to 5 years of work in their current position. The remaining two respondents (25%) indicated 6 to 10 years of work in their current position.

Years Worked in the Organization. Survey respondents were asked to indicate the number of years worked in their organization. The provided ranges for responses included less than 2 years, 2 to 5 years, 6 to 10 years and greater than 10 years. Of the eight respondents, one (12.5%) indicated having worked in their organization for less than 2 years; three (37.5%) indicated having worked in their organization for 2 to 5 years and four (50%) indicated having worked in their organization for 10 or more years. None of the respondents indicated having worked in their organization for 5 to 10 years.

Business Functions. The last item of the individual profile sub-section asked respondents to indicate which business function(s) best described their individual responsibilities. The provided response categories included: “Finance, Production/Operations Management”, “Logistics/Transportation/Distribution”, “Supply/Purchasing/Procurement”, “Information Technology”, “Sales/Marketing”, “Engineering/Product Development”, and “Other”. Six of the eight respondents (75%) identified their responsibilities as being best described with those of the Logistics/Transportation/Distribution functions while two (25%) indicated their responsibilities also fell into the Production/Operations Management. Two other respondents (25%) indicated the Supply/Purchasing/Procurement category as best

describing their responsibilities in addition to the logistics, transportation and distribution functions.

Company Profile

Respondents were asked to provide responses to three items pertaining to their company profile. A brief description of the respective items follows.

Personnel Employed. The first item of the company profile sub-section asked respondents to indicate the number of employees working in their organization. The provided ranges for responses were less than 100, 100 to 250, 251 to 500, 501 to 1,000, and more than 1,000. As depicted in Figure 5, the majority of respondents indicated their organization employed over 1,000 employees with the remaining respondents almost equally distributed among the remaining categories.

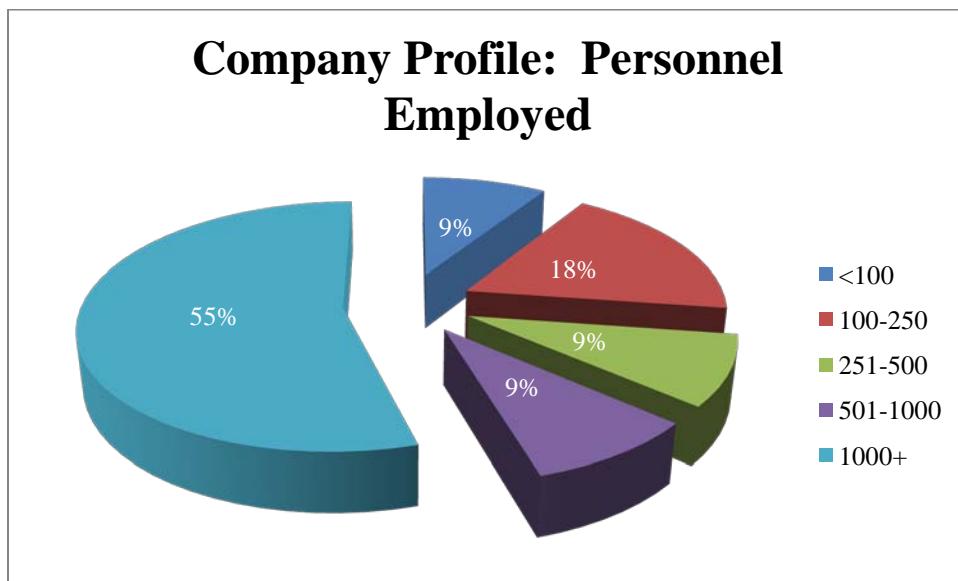


Figure 5. Personnel Employed in Respondents' Firms

Volume of Sales. The next item asked respondents to indicate their organizations, volume of sales measured in millions of dollars. The categories provided for respondents were less than 10 million dollars, between 10 and 25 million dollars, between 25 and 50

million dollars, between 50 and 100 million dollars, between 100 and 500 million dollars and greater than 500 million dollars. As illustrated in Figure 6, the majority of respondents indicated their organization exceeded 500 million dollars in sales on an annual basis. The remaining respondents indicated an annual volume of sales for their organization that fell within the 10 to 25 million dollar or 50 to 100 million dollar range.

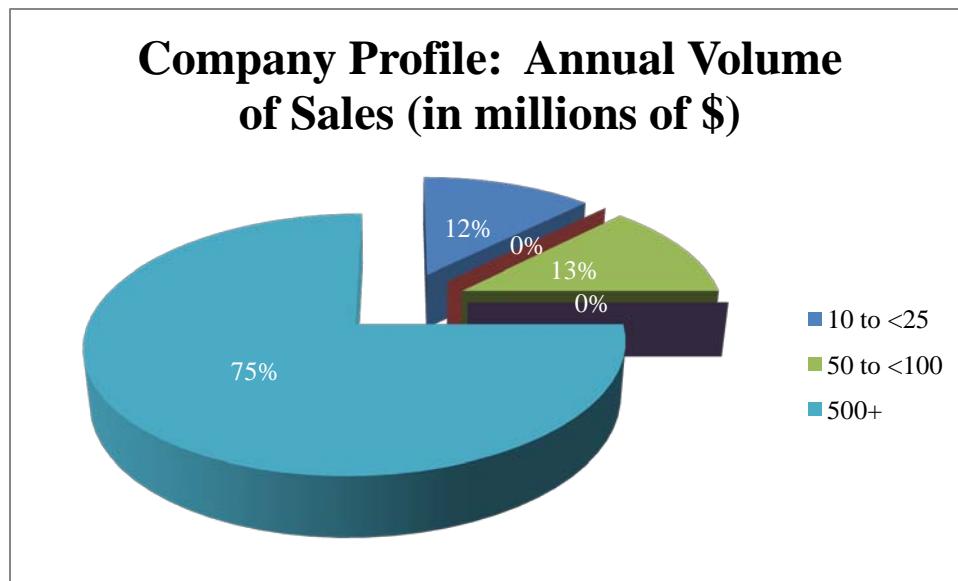


Figure 6. Annual Volume of Sales of Respondents' Firms (in millions of \$).

Industry Classification. The final item in the company profile sub-section asked respondents to indicate the North American industry classification code which best described their organization's business. The specific two-digit sector codes were taken from the 2007 North American Industry Classification System and are listed in Table 1. Of the eight respondents, four indicated their firm belonged to the manufacturing sector while three of the remaining respondents indicated their firm belonged to either the wholesale trade, transportation and warehousing or retail trade sectors. One respondent indicated their firm did not fall within the range of provided sector codes (Figure 7).

Table 1. Industry Classification System Sector Codes (Bureau, 2011).

Sector Code	Description
11	Agriculture, Forestry, Fishing and Hunting
21	Mining, Quarrying, and Oil and Gas Extraction
22	Utilities
23	Construction
31 – 33	Manufacturing
42	Wholesale Trade
44 – 45	Retail Trade
48 - 49	Transportation and Warehousing
51	Information
52	Finance and Insurance
53	Real Estate and Rental and Leasing
54	Professional, Scientific, and Technical Services
55	Management of Companies and Enterprises
56	Administrative and Support and Waste Management and Remediation Services
61	Educational Services
62	Health Care and Social Assistance
71	Arts, Entertainment, and Recreation
72	Accommodation and Food Services
81	Other Services (except Public Administration)
92	Public Administration

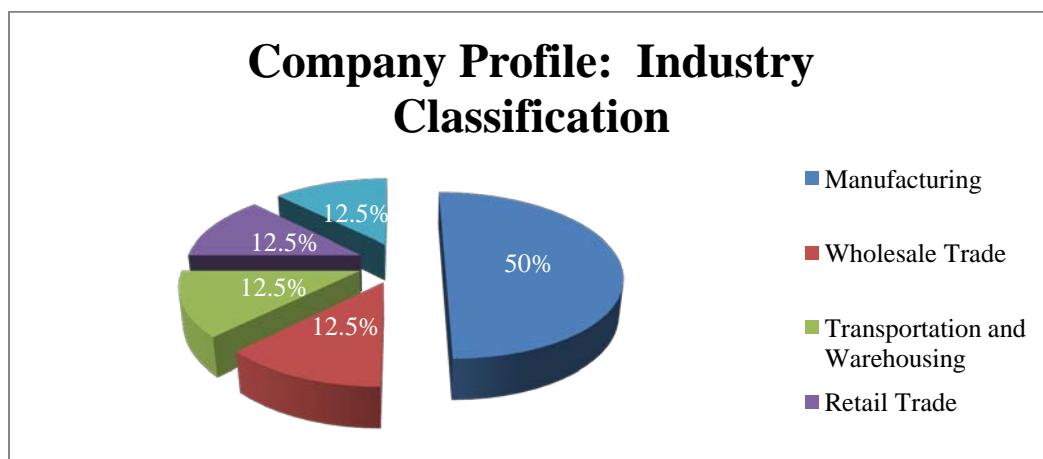


Figure 7. Industry Classification of Respondents' Firms

Analysis of Survey Respondent Demographics

An analysis of survey respondent demographics based on company profile data and the variables computed for the respective components of the proposed model was conducted in order to determine if any noteworthy differences existed between respondents. In particular, the Mann-Whitney test (also known as the Mann-Whitney-Wilcoxon (MWW) test or the Wilcoxon rank-sum test) was used to determine if respondents differed in levels of process implementation, competitive advantage or organizational performance based on the size of the firm (number of personnel employed), annual sales volume or industry classification. The Mann-Whitney test was chosen as the preferred method because it is appropriate for small sample sizes and does not depend on the same assumptions found in parametric methods (i.e. normality of data) which are not appropriate in this situation. As stated by Anderson, Sweeney, and Williams (2009), “the only requirement of the MWW test is that the measurement scale for the data is at least ordinal” (p. 825). Furthermore, instead of testing for the difference between the means of two independent samples of the two populations, the test determines whether the two populations are identical. One limitation of the test is that, unlike other non-parametric methods, when the null hypothesis of the test is rejected, nothing can be stated about how the two samples differ. If, however, it is believed that the samples and their underlying populations are essentially the same in every aspect but the means, a rejection of the null hypothesis implies that the means differ (Anderson, Sweeney and Williams, 2009). The hypotheses for the test are as follows:

$$H_0: \text{The two populations are identical}$$

$$H_1: \text{The two populations are not identical}$$

To conduct the test, the necessary variables for CSM, OF, DM, CA and OP were computed using SPSS. Respondents were divided into two categories based on responses to the company profile sub-section of the survey and then compared on the basis of process implementation, competitive advantage and organizational performance variables using the Mann-Whitney test in SPSS (Table 2).

Table 2. Mann-Whitney Test Categories.

Company Profile Item	Category 1		Category 2	
# of Personnel Employed	> 1,000	n = 6	≤ 1000	n = 2
Annual Volume of Sales	> \$500M	n = 6	≤ 500	n = 2
Industry Classification	Manufacturing	n = 4	Other	n = 4

In all cases, the null hypothesis was retained suggesting no difference in median scores of respondents belonging to either of the categories created based on the items comprising the company profile sub-section. This result is likely due to the limited variation associated with such a small sample size as differences would be expected in the larger population. The SPSS output for the non-parametric analyses are provided in Tables 3, 4 and 5.

Table 3. Mann-Whitney Test Based on Personnel Employed.

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of OrderFulfillment is the same across categories of Personnel_Employed.	Independent-Samples Mann-Whitney U Test	.502	Retain the null hypothesis.
2	The distribution of CustomerServiceManagement is the same across categories of Personnel_Employed.	Independent-Samples Mann-Whitney U Test	1.000	Retain the null hypothesis.
3	The distribution of DemandManagement is the same across categories of Personnel_Employed.	Independent-Samples Mann-Whitney U Test	.739	Retain the null hypothesis.
4	The distribution of CompetitiveAdvantage is the same across categories of Personnel_Employed.	Independent-Samples Mann-Whitney U Test	.180	Retain the null hypothesis.
5	The distribution of OrganizationalPerformance is the same across categories of Personnel_Employed.	Independent-Samples Mann-Whitney U Test	.845	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 4. Mann-Whitney Test Based on Annual Volume of Sales.

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of OrderFulfillment is the same across categories of Annual_Volume_of_Sales.	Independent-Samples Mann-Whitney U Test	.502	Retain the null hypothesis.
2	The distribution of CustomerServiceManagement is the same across categories of Annual_Volume_of_Sales.	Independent-Samples Mann-Whitney U Test	1.000	Retain the null hypothesis.
3	The distribution of DemandManagement is the same across categories of Annual_Volume_of_Sales.	Independent-Samples Mann-Whitney U Test	.739	Retain the null hypothesis.
4	The distribution of CompetitiveAdvantage is the same across categories of Annual_Volume_of_Sales.	Independent-Samples Mann-Whitney U Test	.180	Retain the null hypothesis.
5	The distribution of OrganizationalPerformance is the same across categories of Annual_Volume_of_Sales.	Independent-Samples Mann-Whitney U Test	.845	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 5. Mann-Whitney Test Based on Industry Classification.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of OrderFulfillment is the same across categories of Annual_Volume_of_Sales.	Independent-Samples Mann-Whitney U Test	.502	Retain the null hypothesis.
2	The distribution of CustomerServiceManagement is the same across categories of Annual_Volume_of_Sales.	Independent-Samples Mann-Whitney U Test	1.000	Retain the null hypothesis.
3	The distribution of DemandManagement is the same across categories of Annual_Volume_of_Sales.	Independent-Samples Mann-Whitney U Test	.739	Retain the null hypothesis.
4	The distribution of CompetitiveAdvantage is the same across categories of Annual_Volume_of_Sales.	Independent-Samples Mann-Whitney U Test	.180	Retain the null hypothesis.
5	The distribution of OrganizationalPerformance is the same across categories of Annual_Volume_of_Sales.	Independent-Samples Mann-Whitney U Test	.845	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Measures

The 163-item survey questionnaire consisted of a total of ten scales; one for each key SCM process and one each for competitive advantage and organizational performance. Items comprising the process scales were generated based on Lambert et al.'s (2008) assessment tool for SCM implementation while the scales for both competitive advantage and organizational performance were adopted from Li et al

(2004). Each of the process implementation response scales as well as the CA scale were measured along a five-point Likert scale with the following possible responses provided as options: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree. An additional response— 6 = not-applicable—was provided as an option for items which either did not apply to the respondent or for which the respondent could not otherwise provide a response. Responses to the OP items required participants to indicate their firm's performance as compared to the perceived industry average and were measured using a five-point Likert-type scale consisting of the following responses options: 1 = significantly lower, 2 = lower, 3 = average, 4 = higher, 5 = significantly higher, 6 = not applicable. Additionally, details regarding individual respondents and their respective organizations were also gathered. The complete survey as it appeared in its web-based form can be found in Appendix A. The following section discusses the 74 items/five scales of interest to this specific study (i.e. CSM, OF, DM, CA, OP) as well as the individual respondent and associated firm demographics.

Customer Service Management

The CSM scale was made up of 13 items which sought to measure the degree to which respondents perceived strategic sub-processes related to CSM had been implemented within their organization. Of the scale's 13 items, items 4 and 11 were reverse-scored. Responses ranged from 2.92 to 4.08 with a mean of 3.73 ($SD=0.37$, $n=8$). The internal consistency of the scale was measured by computing the scale reliability in SPSS. The reported Cronbach's alpha was 0.87 ($N=13$) and met the minimum cut-off level of 0.70 generally accepted in survey research (DeVellis, 2003).

Order Fulfillment

The OF scale was made up of 20 items which sought to measure the degree to which respondents perceived strategic sub-processes related to OF had been implemented within their organization. The following items were reverse-scored: 4, 6, 7, 13, 15, 17 and 20. Responses ranged from 3.45 to 4.10 with a mean of 3.80 ($SD=0.23$, $n=8$). The internal consistency of the scale was measured by computing the scale reliability in SPSS. The reported Cronbach's alpha was 0.30 ($N=13$) and did not meet the minimum cut-off level for scale reliability.

Demand Management

The DM scale was made up of 13 items which sought to measure the degree to which respondents perceived strategic sub-processes related to DM had been implemented within their organization. For the DM scale, items 3 and 7 were reverse-scored. Responses ranged from 1.54 to 4.62 with a mean of 3.39 ($SD=1.02$, $n=8$). The internal consistency of the scale was measured by computing the scale reliability in SPSS. The reported Cronbach's alpha was 0.93 ($N=13$).

Competitive Advantage

The CA scale was made up of 14 items which sought to measure the degree to which respondents perceived their firm was able to maintain a defensible position over competitors. Responses ranged from 2.93 to 4.21 with a mean of 3.48 ($SD=0.43$, $n=8$). The internal consistency of the scale was measured by computing the scale reliability in SPSS. The reported Cronbach's alpha was 0.74 ($N=14$).

Organizational Performance

The OP scale was made up of seven items which measured the degree to which a respondent's organization achieved its market-oriented and financial goals. Responses ranged from 1.14 to 4.00 with a mean of 3.37 (SD=1.00, n=8). The internal consistency of the scale was measured by computing the scale reliability in SPSS. The reported Cronbach's alpha was -0.04 (N=7).

Demographics

Demographics of the individual respondents as well as their respective organizations were gathered through four individual profile questions covering job title, years worked in the position, years worked in the organization and applicable business functions. Company profile data was gained through three items which covered the number of personnel employed by the organization, annual volume of sales and industry classification.

Selected descriptive statistics as well as reliabilities for each of the computed variables/scales are summarized in Table 6.

Table 6. Descriptive Statistics and Scale Reliabilities (Response Data).

Variable/Scale	Mean	Standard Deviation	n	Cronbach's α	# of Items
Customer Service Management	3.73	0.37	8	0.87	13
Order Fulfillment	3.80	0.23	8	0.30	20
Demand Management	3.39	1.02	8	0.93	13
Competitive Advantage	3.48	0.43	8	0.74	14
Organizational Performance	3.37	1.00	7	-0.04	7

Instrument Validation

The instrument validation process began with a focus on ensuring content validity. This was achieved through an extensive review of GSCF-specific literature as well as relevant literature from studies which exhibited the type of research intended for this study. Additionally, all three researchers which contributed to the development of the questionnaire were students of one of the key contributors to the GSCF-specific literature during a capstone SCM course based on the book written by Lambert et al (2008). The survey items were reviewed with the help of several academicians familiar with the survey-building process. Finally, the survey was pilot-tested in the web-based format by a group of academic professionals as well as a technician with significant experience in establishing web-based surveys. Due to the low response rate and subsequent small sample size, further efforts to establish validity and reliability were significantly limited. An attempt was made to establish convergent and divergent validity through correlation analysis, however, none of the variables displayed significant correlations. Additionally, an attempt to validate the instrument through factor analysis using SPSS. However, owing to the limited sample size, factor analysis was unable to be completed. Another effort to explore the factor structure was made using simulated survey responses.

Simulated Survey Responses

In order to simulate survey responses, data was generated using a combination of the random number generator (i.e. “RAND()”) and the inverse of the normal distribution function (i.e. “NORMINV(probability, mean, standard deviation)”) in Microsoft Excel. Specifically, the mean and standard deviations were computed for each individual item of

the CSM, OF, DM, CA and OP scales. Using the random number generator as the probability input for the inverse of the normal distribution function, simulated responses were produced for 260 cases in order to achieve confidence intervals at the 0.05 significance level. Furthermore, as noted by DeVellis (2003), factor analysis depends greatly on the ratio of items to cases for a given scale with the rule of thumb for achieving a stable factor solution being a ratio of approximately 1 to 10 (p. 137). The simulated data set satisfied this requirement for the scales considered.

Once responses were generated for each of the items, the simulated data set was then cleaned to eliminate any “not applicable” responses. Variables were computed as well as scale reliabilities using pairwise deletion. Selected descriptive statistics as well as reliability coefficients for the simulated data set are reported in Table 7.

Table 7. Descriptive Statistics and Scale Reliabilities (Simulated Data).

Variable/Scale	Mean	Standard Deviation	n	Cronbach's α	# of Items
Customer Service Management	3.97	0.37	231	0.87	13
Order Fulfillment	3.37	0.19	211	0.47	20
Demand Management	3.87	0.42	213	0.83	13
Competitive Advantage	3.67	0.26	167	0.82	14
Organizational Performance	4.24	0.52	251	0.97	7

With the larger, simulated data set, factor analysis was conducted in SPSS. Initial efforts to produce a solution failed due to low variance of several items therefore, an effort was made to inflate the variance by replacing missing values with the mean response score for the respective items. Applying principal component analysis with oblique rotation yielded a factor solution which suggested seven underlying variables.

Moreover, the overwhelming majority of items loaded on a single factor which did not at all mirror the expected factor structure (Appendix C). An effort to force the solution to four factors again failed to yield simple structure corresponding to the structure conceptualized in the relevant literature (Appendix D). Overall, unfavorable factor analysis results are likely due to the limited variance in the sample as well as high inter-item correlations.

IV. Results

Overview

It was the goal of this study to validate the relationships between key SCM processes, as defined by the GSCF framework, competitive advantage and organizational performance. The following discussion reports the analysis and results pertaining to the proposed hypotheses based on both the original survey data as well as the simulated data.

Hypothesis 1

As indicated in the literature, implementation of key SCM processes was expected to be positively related to competitive advantage. Variables were computed for each respective SCM process as well as CA and a bivariate correlation analysis conducted in SPSS for both the original data and the simulated data set. For the original data set (n=8), correlation analysis failed to support Hypothesis 1 as there were no statistically significant correlations. For the simulated data set, correlation analysis provided support for this hypothesis across the board as implementation of the CSM, OF, and DM processes were all highly and significantly correlated with CA.

Hypothesis 2

As suggested by the relevant literature, implementation of key SCM processes was expected to be positively related to the performance of a firm. The variable for OP was computed and a bivariate correlation analysis was conducted in SPSS for both the original and simulated data sets. In the case of the original data set, this hypothesis was not supported. However, the hypothesis was supported by the simulated data set in all

cases. That is, implementation of the CSM, OF, and DM processes were highly and significantly correlated with OP therefore providing support for this hypothesis.

Hypothesis 3

Relevant SCM literature suggested high levels of competitive advantage would be associated with high levels of organizational performance. To assess this hypothesis, bivariate correlation analysis was conducted in SPSS for both the original data set as well as the simulated responses. In the case of the original data set, this hypothesis was not supported. With the simulated data set, this hypothesis was supported.

Summary

In all cases, none of the hypotheses were supported when bivariate correlation analysis was conducted using the original data set. This is to be expected considering the limited variation in the sample. On the other hand, support for all three hypotheses was found in bivariate correlation analysis of the simulated response data. Ironically, this too is likely due to the limited variation in the generated survey data. The respective correlation statistics and associated significance levels for both data sets are provided in Table 8 and 9.

Table 8. Bi-variate Correlation Analysis Summary (Original Data).

		Correlations				
		Order Fulfillment	Customer Service Management	Demand Management	Competitive Advantage	Organizational Performance
OrderFulfillment	Pearson Correlation	1	-.01	.58	.07	.33
	Sig. (2-tailed)		.99	.13	.86	.47
	N	8	8	8	8	7
Customer Service Management	Pearson Correlation	-.01	1	.28	.12	-.03
	Sig. (2-tailed)	.99		.51	.78	.95
	N	8	8	8	8	7
Demand Management	Pearson Correlation	.58	.28	1	.37	-.18
	Sig. (2-tailed)	.13	.51		.37	.70
	N	8	8	8	8	7
Competitive Advantage	Pearson Correlation	.07	.12	.37	1	.47
	Sig. (2-tailed)	.86	.78	.37		.29
	N	8	8	8	8	7
Organizational Performance	Pearson Correlation	.33	-.03	-.18	.47	1
	Sig. (2-tailed)	.47	.95	.70	.29	
	N	7	7	7	7	7

Table 9. Bivariate Correlation Analysis Summary (Generated Data)

		Correlations				
		Customer Service Management	Order Fulfillment	Demand Management	Competitive Advantage	Organization Performance
Customer Service Management	Pearson Correlation	1	.88**	.96**	.91**	.94**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	231	211	213	167	231
Order Fulfillment	Pearson Correlation	.88**	1	.93**	.85**	.77**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	211	211	208	167	211
Demand Management	Pearson Correlation	.96**	.93**	1	.96**	.87**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	213	208	213	165	213
Competitive Advantage	Pearson Correlation	.91**	.85**	.96**	1	.90**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	167	167	165	167	167
Organization Performance	Pearson Correlation	.93**	.77**	.87**	.90**	1
	Sig. (2-tailed)		.000	.000	.000	
	N	231	211	213	167	251

**. Correlation is significant at the 0.01 level (2-tailed).

V. Conclusion

While this study failed to offer significant findings in regard to validating the GSCF framework on SCM, several observations and considerations which may aid further research efforts are worth noting. First, to the degree that the simulated response data represents the true population of mid-level managers and executive leaders, the analysis performed suggests that those concerned with the implementation of SCM processes can expect a resulting enhancement in both the competitive position and performance of their organization. Likewise, the analysis suggests that both competitive advantage and organizational performance are positively correlated. While Li et al. (2004) found evidence of both a causal and recursive relationship through the application of structural equation modeling methods, further analysis on the relationship between these two variables within the context of the GSCF framework is necessary to establish an actual causal relationship between these two variables and offer additional validation to Li et al (2004). Overall, these conclusions reflect the expected relationships between the constructs discussed. However, it must be acknowledged that the data on which this research depends brings certain limitations to the study.

Specifically, the limited variation in the data and the likelihood that the data do not represent the greater population limit the ability to establish dependable scales and hamper any claims to external validity. That said this research effort did produce a survey instrument which can be used as a spring board for measuring the concepts and relationships advanced by both the GSCF-specific literature as well as other related SCM literature. While several factors likely contributed to the low response rate experienced

in this study, perhaps the most influential factor was the length of the survey. It may be necessary to revisit the tradeoffs between anticipated response rate and the potential information to be gathered by inclusion of certain items in the survey. Admittedly, with 163 items, the survey may require too great of a time investment from business leaders who are, no doubt, very busy individuals. Of course, the combination of securing a larger pool (i.e. greater than 800) of potential participants and/or allowing for a longer time horizon for administering the survey would greatly aid the research effort. Feedback from some of the survey respondents also indicated the possibility that distribution list used was from a heavily-sampled population and may have also contributed to the low response rate.

Also of note, this study was able to contribute to existing research through the development of a proposed validation model which reflects the concepts and relationships advanced in existing SCM literature. Future research may possibly improve upon the proposed model by incorporating contextual factors since not all practitioners operate in the same environment (Ho, Au, & Newton, 2000). Along the same lines, this insight may dictate whether or not and to what degree the operational sub-processes of the framework are factored into future efforts to validate the framework. Even more, this insight may prompt a deeper analysis of the proposed validation model and survey instrument to enhance external validity as it pertains to understanding firms which operate in the service as opposed to manufacturing industry.

Furthermore, as Ho, Au, and Newton (2000) discuss, it may be desirable to not only measure the effects and interactions of individual processes or practices as they relate to competitive advantage and organizational performance but, to also measure the

relationship between the aggregate effect of SCM processes and measures of performance. This may require changes to the proposed validation model and implies the application of structural equation modeling methods.

Lastly, the proposed model does not factor in overall supply chain performance and looks only at the relationship between implementation of SCM processes and performance of a given focal firm. Greater understanding and conceptualization of SCM may benefit from an analysis which factors in comparisons of supply chains based on levels of process implementation. One of the challenges, however, lies in finding performance measures which are widely understood and practical.

In summation, the purpose of this study was to explore the relationships between the GSCF framework constructs in order to inform attempts at business leader implementation of key processes at the strategic level. In doing so, this study intended to further the scientific development of SCM theory through empirical validation of the GSCF framework. While the study was severely limited in its ability to offer any meaningful insight regarding the efficacy of the framework due to an extremely low response rate, a proposed model and related survey instrument were developed and offered to inform future research endeavors. With a more focused survey-administration process and refinement of the validation model, future research is on good footing to offer invaluable insight to the field of supply chain management.

Appendix A: Survey Instrument



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Survey meets criteria for exclusion for a SCN under 32 CFR 219, DoDD 3216.2, and AFI 40-40

Privacy Notice

The following information is provided as required by the Privacy Act of 1974:

Purpose:

Dear Anthonelli White

The Global Supply Chain Forum (GSCF) defines supply chain management (SCM) as "the integration of key business processes from end-user through original suppliers that provides products, services, and information that add value for customers and other stakeholders". The purpose of this survey is to measure the perceived benefits of implementing the eight SCM processes identified by the GSCF framework as they pertain to competitive advantage and organizational performance. Results from this survey will be reported to all interested participants and used to shed light on the leading edge supply chain management practices currently being implemented throughout industry.

This survey will take approximately 25-30 minutes based on your answers.

Participation: We would greatly appreciate your participation in our data collection effort. Your participation is **COMPLETELY VOLUNTARY**. Your decision not to participate or to withdraw from participation will not jeopardize your relationship with the Air Force Institute of Technology, the U.S. Air Force, or the Department of Defense.

Confidentiality: We ask for some demographic information at the end of this survey in order to interpret results more accurately. No one other than the research team will see your completed questionnaire. Findings will be reported at the group level only.

Instructions

This survey consists of various statements which will measure the degree to which your firm has implemented certain supply chain management processes. For each section, please indicate the degree to which you agree or disagree with the associated statements. If you are uncertain how to answer a particular question, or if the process does not apply to your firm, please choose the "**not applicable**" response. Also, please answer all questions in the context of your firm which is defined as the business unit at which you are currently employed.

- Base your answers on your own thoughts & experiences
- Please make your answers clear and concise when asked to answer in a response or when providing comments
- Be sure to select the correct option button when asked



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Section I: Customer Relationship Management (CRM)

The CRM process provides the structure for how the relationships with customers will be developed and maintained by segmenting customers based on their value over time.

Product and service agreement (PSA): Formal or informal contract or agreement (that may be referred to by different names from company to company) between two organizations with the purpose of specifying the level of performance that will be provided to meet the needs of both parties.

The scale below utilizes a five-point Likert type scale with responses ranging from:

1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	Our firm has developed a CRM process team.	<input type="radio"/>					
2	Our firm utilizes cross-functional input within the CRM process.	<input type="radio"/>					
3	Our firm ensures our CRM process is aligned with our corporate strategy.	<input type="radio"/>					
4	Our firm identifies target segments that are critical to our organization's success.	<input type="radio"/>					
5	Our firm develops guidelines for the degree of differentiation in PSAs.	<input type="radio"/>					
6	Our firm documents our business relationships with customers through formal PSAs.	<input type="radio"/>					
7	Our firm develops PSAs that do not enhance the profitability of the firm.	<input type="radio"/>					
8	Our firm provides customized PSAs for key customers.	<input type="radio"/>					
9	Our firm provides standard PSAs for customer segments.	<input type="radio"/>					
10	Our firm develops PSAs that do not enhance the profitability of our customers.	<input type="radio"/>					
11	Our firm develops metrics that are related to the customer's impact on our firm's profitability.	<input type="radio"/>					
12	Our firm develops metrics that are related to our firm's impact on the customer's profitability.	<input type="radio"/>					
13	Our firm's CRM metrics are tied back to our firm's financial performance.	<input type="radio"/>					
14	Our firm does not measure customer profitability over time.	<input type="radio"/>					
15	Our firm's CRM metrics are aligned with other metrics used throughout the firm.	<input type="radio"/>					
16	Our firm's people understand how their decisions/actions affect the CRM process.	<input type="radio"/>					
17	Our firm's key suppliers do not understand how their decisions/actions affect the CRM process.	<input type="radio"/>					
18	Our firm's customers understand how their decisions/actions affect the CRM process.	<input type="radio"/>					
19	Our firm uses guidelines for sharing process improvement benefits with customers.	<input type="radio"/>					



Section II: Order Fulfillment (OF)

The OF process includes all activities necessary to design a network and enable a firm to meet customer requests while minimizing the total delivered cost.

The scale below utilizes a five-point Likert type scale with responses ranging from:

1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	Our firm has developed an OF process team.	<input type="radio"/>					
2	Our firm utilizes cross-functional input within the OF process.	<input type="radio"/>					
3	Our firm understands how our OF process is tied to our customer service strategy.	<input type="radio"/>					
4	Our firm does not understand how our OF process is tied to our marketing strategy.	<input type="radio"/>					
5	Our firm's OF process is designed around the customer.	<input type="radio"/>					
6	Our firm has not identified our core competencies within order fulfillment.	<input type="radio"/>					
7	Our firm does not adhere to our order fulfillment budget.	<input type="radio"/>					
8	Our firm works with customers to understand their order fulfillment requirements.	<input type="radio"/>					
9	Our firm regularly improves the structure of our logistics network.	<input type="radio"/>					
10	Our firm differentiates order fulfillment terms/policies for each customer segment based on profitability.	<input type="radio"/>					
11	Our firm establishes rules for how product is allocated between customers/customer segments.	<input type="radio"/>					
12	Our firm utilizes technology to support our order fulfillment activities.	<input type="radio"/>					
13	Our firm has not established ordering rules that minimize demand variability (e.g. payment terms, minimum order sizes, etc.).	<input type="radio"/>					
14	Our firm has order fulfillment metrics that are tied back to financial performance.	<input type="radio"/>					
15	Our firm does not have performance goals that are related to order fulfillment.	<input type="radio"/>					
16	Our firm has order fulfillment goals that are understood throughout the firm.	<input type="radio"/>					
17	Our firm's order fulfillment metrics are not aligned with other metrics used throughout the firm.	<input type="radio"/>					
18	Our firm's people understand how their decisions/actions affect the order fulfillment process.	<input type="radio"/>					
19	Key suppliers do not understand how their decisions/actions affect the OF process.	<input type="radio"/>					
20	Our firm's customers do not understand how their decisions/actions affect the OF process.	<input type="radio"/>					



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Section III: Returns Management (RM)

The RM process includes all activities associated with returns, reverse logistics, gatekeeping, and avoidance that are managed within the firm and across key members of the supply chain.

Reverse Logistics: the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal.

Avoidance: finding ways to minimize the number of return requests.

Gatekeeping: making decisions to limit the number of items that are allowed into the reverse flow.

The scale below utilizes a five-point Likert type scale with responses ranging from:

1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	<u>NOT APPLICABLE</u>
							6
1	Our firm has formally developed a RM process team.	<input type="radio"/>					
2	Our firm uses cross-functional input to frame the role of returns management within the corporate strategy.	<input type="radio"/>					
3	Our firm evaluates the best alternatives to recapture value from returns.	<input type="radio"/>					
4	Our firm regularly assesses our organization's level of preparedness to comply with potential environmental/legal requirements that may affect returns management.	<input type="radio"/>					
5	Our firm does not consider internal constraints/capabilities when determining goals/strategy for returns management.	<input type="radio"/>					
6	Our firm has not identified types of returns.	<input type="radio"/>					
7	Our firm has procedures for identifying avoidance opportunities.	<input type="radio"/>					
8	Our firm has not developed refund policies.	<input type="radio"/>					
9	Our firm has not developed gatekeeping policies.	<input type="radio"/>					
10	Our firm has developed disposition guidelines.	<input type="radio"/>					
11	Our firm has designed a reverse logistics network that minimizes the supply chain's reverse logistics costs.	<input type="radio"/>					
12	Our firm has not developed plans for dealing with product recalls.	<input type="radio"/>					
13	Our firm has developed a method of valuing returned product.	<input type="radio"/>					
14	Our firm's supply chain partners understand our credit authorization procedures.	<input type="radio"/>					
15	Our firm's credit policies were developed with input from our supply chain partners.	<input type="radio"/>					
16	Our firm has developed rules about using secondary markets.	<input type="radio"/>					
17	Our firm has not developed remanufacturing/refurbishing strategies.	<input type="radio"/>					
18	Our firm has returns management metrics that are related to financial performance.	<input type="radio"/>					
19	Our firm's people do not understand how their decisions/actions affect the RM process.	<input type="radio"/>					
20	Our firm's supply chain partners understand how their decisions/actions affect the RM process.	<input type="radio"/>					



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Section IV: Customer Service Management (CSM)

The CSM process deals with the administration of product and service agreements (PSAs) developed by customer teams as part of the customer relationship management process. Customer service managers monitor the PSAs and proactively intervene on the customer's behalf if there is going to be a problem delivering on promises that have been made.

The scale below utilizes a five-point Likert type scale with responses ranging from:

1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	<u>NOT APPLICABLE</u>
1	2	3	4	5	6		
1	Our customer service strategy is executed well throughout the firm.	<input type="radio"/>					
2	Our firm uses cross-functional input within the CSM process.	<input type="radio"/>					
3	Our customer service representatives respond to customer service issues with formally-developed response procedures.	<input type="radio"/>					
4	Our firm does not understand the internal coordination required to respond to customer service events.	<input type="radio"/>					
5	Our firm has mechanisms in place for responding to customer service issues prior to the customer being impacted.	<input type="radio"/>					
6	Our firm understands the external coordination required to respond to various customer service events.	<input type="radio"/>					
7	Our firm responds to customer service issues before the customer is impacted.	<input type="radio"/>					
8	Our firm uses information systems to aid with the information flow related to CSM.	<input type="radio"/>					
9	Our firm has developed formal CSM metrics.	<input type="radio"/>					
10	Our firm understands how CSM metrics impact financial performance.	<input type="radio"/>					
11	Our firm does not have formal performance goals relating to CSM.	<input type="radio"/>					
12	Our firm's key suppliers understand how their decisions/actions affect the CSM process.	<input type="radio"/>					
13	Our firm's key customers understand how their decisions/actions affect the CSM process.	<input type="radio"/>					



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Section V: Demand Management Process (DM)

The DM process balances the customers' requirements with the capabilities of the supply chain. The process includes forecasting and other efforts to increase flexibility through synchronizing supply and demand and reducing variability. The process also includes efforts to coordinate marketing requirements and production plans on an enterprise-wide basis or efforts made towards synchronizing production rates to manage inventories globally.

The scale below utilizes a five-point Likert type scale with responses ranging from:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
							6
1	Our firm's demand management strategy is executed well throughout the firm.	<input type="radio"/>					
2	Our firm uses cross-functional input within the DM process.	<input type="radio"/>					
3	Our firm has not identified the bottlenecks in our supply chain.	<input type="radio"/>					
4	Our firm's forecasts are coordinated with key suppliers.	<input type="radio"/>					
5	Our firm's forecasts are coordinated within the firm such that everyone's planning is based on the same numbers.	<input type="radio"/>					
6	Our firm's forecasts are coordinated with key customers.	<input type="radio"/>					
7	Our firm does not have formal synchronization procedures in place to match supply with demand.	<input type="radio"/>					
8	Our firm understands the production/inventory capacity available at key points in the supply chain.	<input type="radio"/>					
9	Our firm has mechanisms to help synchronize supply and demand during contingencies.	<input type="radio"/>					
10	Our firm has developed formal DM metrics.	<input type="radio"/>					
11	Our firm understands how DM metrics impact financial performance.	<input type="radio"/>					
12	Our firm's key suppliers understand how their decisions/actions affect the DM process.	<input type="radio"/>					
13	Our firm's key customers understand how their decisions/actions affect the DM process.	<input type="radio"/>					



Section VI: Supplier Relationship Management (SRM)

SRM is the supply chain management process that provides the structure for how relationships with suppliers are developed and maintained. With regard to your organization's supplier relationship management process, please choose the appropriate number to indicate the extent to which you agree or disagree with each statement.

Product and service agreement (PSA): Formal or informal contract or agreement (that may be referred to by different names from company to company) between the two organizations with the purpose of specifying the level of performance that will be provided to meet the needs of both parties.

The scale below utilizes a five-point Likert type scale with responses ranging from:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	Our firm has examined how corporate strategy influences the SRM process.	<input type="radio"/>					
2	SRM process requirements are determined by a cross-functional team.	<input type="radio"/>					
3	Our firm has not identified key criteria for segmenting suppliers.	<input type="radio"/>					
4	Our firm documents our relationships with suppliers through formal PSAs.	<input type="radio"/>					
5	Our firm provides supplier teams with formal boundaries for the degree of customization desired in PSAs.	<input type="radio"/>					
6	Our firm has SRM metrics that are related to our firm's financial performance.	<input type="radio"/>					
7	Our firm does not have formal performance goals for supplier relationship management.	<input type="radio"/>					
8	Our firm regularly measures our supplier's contributions to our profitability.	<input type="radio"/>					
9	Our firm regularly measures the impact our business has on a supplier's profitability.	<input type="radio"/>					
10	Conflicting functional objectives often hinder the performance of the supplier relationship process.	<input type="radio"/>					
11	People throughout our firm understand how their decisions/actions affect the SRM process.	<input type="radio"/>					
12	Our key suppliers understand how their decisions/actions affect the SRM process.	<input type="radio"/>					
13	Our customers understand how their decisions/actions affect the SRM process.	<input type="radio"/>					
14	Our firm does not share benefits from process improvements with suppliers.	<input type="radio"/>					



Section VII: Manufacturing Flow Management (MFM)

MFM is the supply chain management process that includes all activities necessary to obtain, implement, and manage manufacturing flexibility in the supply chain and to move products through the plants.

Postponement: Retaining the product in a neutral and non committed status as long as possible in the manufacturing process.

The scale below utilizes a five-point Likert type scale with responses ranging from:

1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	Our firm has examined how our corporate strategy influences the MFM process.	<input type="radio"/>					
2	Our firm has a formal process for evaluating the expertise that will be needed to use future technologies or fulfill future market needs.	<input type="radio"/>					
3	Our firm has a formal process for assessing future changes in laws and regulations that might affect our manufacturing practices.	<input type="radio"/>					
4	Our firm cannot offer different degrees of manufacturing flexibility to different customers.	<input type="radio"/>					
5	Manufacturing flexibility requirements are determined by a cross-functional team.	<input type="radio"/>					
6	Our firm does not plan for capacity growth for the future.	<input type="radio"/>					
7	Make/buy decisions are based on multiple criteria, with a long term focus.	<input type="radio"/>					
8	Postponement opportunities are evaluated jointly with key customers.	<input type="radio"/>					
9	Postponement opportunities are evaluated jointly with key suppliers.	<input type="radio"/>					
10	Manufacturing capabilities are formally communicated internally.	<input type="radio"/>					
11	Manufacturing capabilities are formally communicated with key customers.	<input type="radio"/>					
12	Manufacturing capabilities are formally communicated with key suppliers.	<input type="radio"/>					
13	Our firm has formal metrics focused on the MFM process.	<input type="radio"/>					
14	Our firm understands how MFM metrics impact financial performance.	<input type="radio"/>					
15	Our firm has formal performance goals relating to the MFM process.	<input type="radio"/>					
16	Our firm has communicated performance goals relating to MFM throughout the firm.	<input type="radio"/>					
17	Conflicting functional objectives hinder the performance of the MFM process.	<input type="radio"/>					
18	People in our firm have a limited understanding of how their decisions/actions affect the MFM process.	<input type="radio"/>					



Section VIII: Product Development and Commercialization (PD&C)

PD&C is the supply chain management process that provides structure for developing and bringing to market new products jointly with customers and suppliers. With regard to your organization's product development and commercialization process, please choose the appropriate number to indicate the extent to which you agree or disagree with each statement.

The scale below utilizes a five-point Likert type scale with responses ranging from:

1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	Our firm has examined how our corporate strategy influences the PD&C process.	<input type="radio"/>					
2	Our firm has an extensive (cross-functional) understanding of our supply chain's constraints/capabilities as they relate to product development activities.	<input type="radio"/>					
3	Our firm does not consider customer feedback with respect to product development activities	<input type="radio"/>					
4	Our firm provides incentives for new product ideas.	<input type="radio"/>					
5	Our firm has evaluated the value of all potential sources of new product ideas and uses them appropriately.	<input type="radio"/>					
6	Our firm does not have an explicit methodology for developing new product ideas.	<input type="radio"/>					
7	Our firm has formal guidelines concerning supplier and/or customer involvement in our PD&C process.	<input type="radio"/>					
8	Our firm does not have formal procedures in place to identify product rollout issues/constraints.	<input type="radio"/>					
9	Our firm has formal guidelines for establishing time-to-market expectations for our PD&C process.	<input type="radio"/>					
10	Our firm has formal guidelines for establishing product profitability targets for our PD&C process.	<input type="radio"/>					
11	Our firm has formal procedures for assessing the strategic fit of new products.	<input type="radio"/>					
12	Our firm has formal metrics focused on product development and commercialization.	<input type="radio"/>					
13	Our firm understands how our PD&C metrics impact financial performance	<input type="radio"/>					
14	Our firm has formal performance goals relating to the PD&C process.	<input type="radio"/>					
15	Our firm's formal performance goals are communicated throughout the firm.	<input type="radio"/>					
16	Our firm's formal performance goals are communicated to our suppliers.	<input type="radio"/>					
17	Our firm's formal performance goals are communicated to our customers.	<input type="radio"/>					
18	Our firm's PD&C metrics are aligned with other metrics used throughout the firm.	<input type="radio"/>					



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Section IX: Competitive Advantage

Competitive advantage is the extent to which an organization is able to create a defensible position over its competitors.

Please indicate the extent to which you agree or disagree with each statement with regard to the competitive advantage of your firm.

The scale below utilizes a five-point Likert type scale with responses ranging from:

1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	<u>NOT APPLICABLE</u>				
					1	2	3	4	5	6
1	We offer competitive prices.	0	0	0	0	0	0	0	0	0
2	We are able to offer prices as low or lower than our competitors.	0	0	0	0	0	0	0	0	0
3	We offer high quality products/services to our customer.	0	0	0	0	0	0	0	0	0
4	We are not able to compete based on quality.	0	0	0	0	0	0	0	0	0
5	We offer products/services that are highly reliable.	0	0	0	0	0	0	0	0	0
6	We offer products that are very durable.	0	0	0	0	0	0	0	0	0
7	We rarely deliver customer orders on time.	0	0	0	0	0	0	0	0	0
8	We provide dependable delivery.	0	0	0	0	0	0	0	0	0
9	We provide customized products/services.	0	0	0	0	0	0	0	0	0
10	We alter our product/services offerings to meet client needs.	0	0	0	0	0	0	0	0	0
11	We do not respond well to customer demand for 'new' features/services.	0	0	0	0	0	0	0	0	0
12	We are first in the market in introducing new products/services.	0	0	0	0	0	0	0	0	0
13	We have time-to-market lower than industry average.	0	0	0	0	0	0	0	0	0
14	We have fast product development.	0	0	0	0	0	0	0	0	0



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Section X: Organizational Performance

Organizational performance is the extent to which a firm achieves its market-oriented goals as well as its financial goals.

Please select the number which best indicates your firm's overall performance for the following areas as compared to the industry average:

The organizational performance scale utilizes a five-point Likert type scale with responses ranging from 1 = Significantly Lower, 2 = Lower, 3 = Average, 4 = Higher, 5 = Significantly Higher, 6 = NOT APPLICABLE (DO NOT KNOW)

	Significantly Lower	Lower	Average	Higher	Significantly Higher	<u>NOT APPLICABLE</u>
						1
1 Market share	<input type="radio"/>					
2 Return on investment	<input type="radio"/>					
3 The growth of market share	<input type="radio"/>					
4 The growth of sales	<input type="radio"/>					
5 Growth in return on investment	<input type="radio"/>					
6 Profit margin on sales	<input type="radio"/>					
7 Overall competitive position	<input type="radio"/>					



Section XI: Demographics

Individual Profile

	CEO/President/Vice President	Director	Manager	Other
	1	2	3	4
1 What is your current job title?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If other, please explain

	Under 2 years	2 – 5 years	6 – 10 years	Over 10 years
	1	2	3	4
2 How many years have you been in your current position?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Under 2 years	2 – 5 years	6 – 10 years	Over 10 years
	1	2	3	4
3 How many years have you been in your current organization?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4 In your current job, what function(s) best describe your responsibilities? Check all that apply.
<input type="checkbox"/> Finance
<input type="checkbox"/> Production/Operations Management
<input type="checkbox"/> Logistics/Transportation/Distribution
<input type="checkbox"/> Supply/Purchasing/Procurement
<input type="checkbox"/> Information Technology
<input type="checkbox"/> Sales/Marketing
<input type="checkbox"/> Engineering/Product Development
<input type="checkbox"/> Other

If other, please explain



Section XI: Demographics (continued)

Company Profile

		Less than 100	100 – 250	251 – 500	501 – 1000	Over 1000	
		1	2	3	4	5	
1	How many full time employees are in your organization?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
		Under 10	10 – < 25	25 – < 50	50 – < 100	100 – < 500	Over 500
		1	2	3	4	5	6
2	What is your organization's annual volume of sales measured in millions of dollars?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	Please select the industry classification code which best describes your firm. Please indicate not applicable ("N/A") if appropriate.						
<input type="radio"/>	11	Agriculture, Forestry, Fishing and Hunting					
<input type="radio"/>	21	Mining, Quarrying, and Oil/Gas Extraction					
<input type="radio"/>	22	Utilities					
<input type="radio"/>	23	Construction					
<input type="radio"/>	31 - 33	Manufacturing					
<input type="radio"/>	42	Wholesale Trade					
<input type="radio"/>	44 - 45	Retail Trade					
<input type="radio"/>	48 - 49	Transportation and Warehousing					
<input type="radio"/>	51	Information					
<input type="radio"/>	52	Finance and Insurance					
<input type="radio"/>	53	Real Estate/Rental and Leasing					
<input type="radio"/>	54	Professional, Scientific, and Technical Services					
<input type="radio"/>	55	Management of Companies and Enterprises					
<input type="radio"/>	56	Administrative and Support and Waste Management and Remediation Services					
<input type="radio"/>	61	Educational Services					
<input type="radio"/>	62	Health Care and Social Assistance					
<input type="radio"/>	71	Arts, Entertainment, and Recreation					
<input type="radio"/>	72	Accommodation and Food Services					
<input type="radio"/>	81	Other Services (except Public Administration)					
<input type="radio"/>	92	Public Administration					
<input type="radio"/>	999	N/A					

FINISH

Appendix B. Factor Analysis Results

Component Matrix^a

	Component						
	1	2	3	4	5	6	7
CSM1	.887			.311			
CSM2	.855		-.358				
CSM3	.914						
R_CSM4	-.869		.381				
CSM5	.914						
CSM6	.887			.311			
CSM7	.815	-.339					
CSM8	.859	.377					
CSM9	.852						
CSM10	.824	-.430					
R_CSM11	-.777	.327					
CSM12	.866		-.335				
CSM13	.866		-.335				
DM1	.821	.378					
DM2	.836	.340					
R_DM3	-.864						
DM4	.906						
DM5	.834						
DM6	.824	-.430					
R_DM7	-.868	.301					
DM8	.859	.377					
DM9	.836	.340					
DM10	.836	.323					
DM11	.859	.377					
DM12	.916						
DM13	.941						
OF1	.817	.468					
OF2	.836	.323					
OF3	.759	.510					
R_OF4	-.865		-.355				
OF5	.859	.377					
R_OF6	-.915						
R_OF7	-.907						
OF8	.836	.323					

OF9	.852						
OF10	.881						
OF11	.853	.308					
OF12	.744	.374		-.455			
R_OF13	-.906						
OF14	.836	-.420					
R_OF15	-.859	-.377					
OF16	.906						
R_OF17	-.815	.339					
OF18	.914						
OF19	.893						
R_OF20	-.880		.365				
CA1	.865		.355				
CA2	.941						
CA3	.646	.309		-.484			
R_CA4	-.757		.471				
CA5				.730		-.477	
CA6	.846		-.374				
CA7	.734	-.374					
CA8	.744	.374		-.455			
CA9	.824	-.430					
CA10	.914						
R_CA11	-.785		.320	.307			
CA12	.866		-.335				
CA13	.803	-.342					
CA14	.901						
OP1	.890						
OP2	.824	-.430					
OP3	.836	-.420					
OP4	.907						
OP5	.836	-.420					
OP6	.815	-.339					
OP7	.827			.370			

Extraction Method: Principal Component Analysis.

a. 7 components extracted.

Appendix C. Factor Analysis Results (Specified Factors)

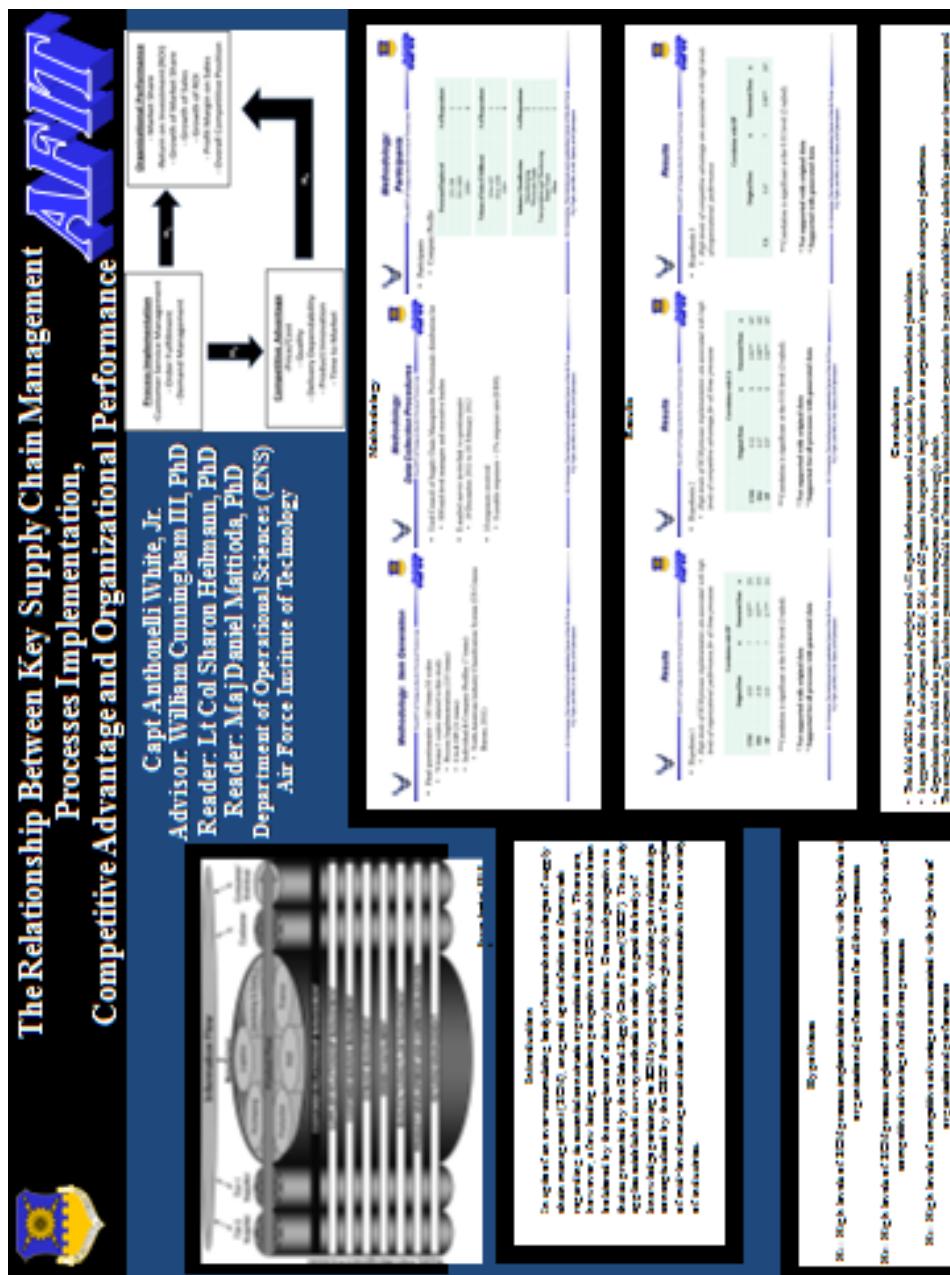
	Component Matrix ^a			
	Component			
	1	2	3	4
CSM1	.887			.311
CSM2	.855		-.358	
CSM3	.914			
R_CSM4	-.869		.381	
CSM5	.914			
CSM6	.887			.311
CSM7	.815	-.339		
CSM8	.859	.377		
CSM9	.852			
CSM10	.824	-.430		
R_CSM11	-.777	.327		
CSM12	.866		-.335	
CSM13	.866		-.335	
DM1	.821	.378		
DM2	.836	.340		
R_DM3	-.864			
DM4	.906			
DM5	.834			
DM6	.824	-.430		
R_DM7	-.868	.301		
DM8	.859	.377		
DM9	.836	.340		
DM10	.836	.323		
DM11	.859	.377		
DM12	.916			
DM13	.941			
OF1	.817	.468		
OF2	.836	.323		
OF3	.759	.510		
R_OF4	-.865		-.355	
OF5	.859	.377		
R_OF6	-.915			
R_OF7	-.907			
OF8	.836	.323		

OF9	.852			
OF10	.881			
OF11	.853	.308		
OF12	.744	.374		
R_OF13	-.906			-.455
OF14	.836	-.420		
R_OF15	-.859	-.377		
OF16	.906			
R_OF17	-.815	.339		
OF18	.914			
OF19	.893			
R_OF20	-.880		.365	
CA1	.865		.355	
CA2	.941			
CA3	.646	.309		-.484
R_CA4	-.757		.471	
CA5				
CA6	.846		-.374	
CA7	.734	-.374		
CA8	.744	.374		-.455
CA9	.824	-.430		
CA10	.914			
R_CA11	-.785		.320	.307
CA12	.866		-.335	
CA13	.803	-.342		
CA14	.901			
OP1	.890			
OP2	.824	-.430		
OP3	.836	-.420		
OP4	.907			
OP5	.836	-.420		
OP6	.815	-.339		
OP7	.827			.370

Extraction Method: Principal Component Analysis.

a. 4 components extracted.

Appendix D. Storyboard



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Vita

Captain Anthonelli White, Jr. graduated from Scott County High School, Georgetown, Kentucky in June 2000. He entered undergraduate studies at the United States Air Force Academy in Colorado Springs, Colorado, where he graduated with a Bachelor of Science degree in Legal Studies and received his commission in June 2004.

His first assignment was at Vandenberg AFB, California where he performed various duties within the 30th Logistics Readiness Squadron and deployed to Southwest Asia. In August 2007, he was re-assigned to the 727th Air Mobility Squadron at Royal Air Force Mildenhall, United Kingdom where he served as the Officer in Charge of Aircraft Services and later as the unit's Operations Officer. While stationed at RAF Mildenhall, he was selected for a joint expeditionary tasking to Kabul, Afghanistan as the Officer in Charge of Transportation, Maintenance and Fuels as part of the Afghanistan Regional Integration and Security Command-Central. Later, he was reassigned as the Senior Logistics Mentor for the Police Mentor Team assigned to the Afghan National Police's Central Regional Command.

In August 2010, he entered the Graduate School of Engineering and Management, Air Force Institute of Technology at Wright Patterson AFB, Ohio. Upon graduation, he will be assigned to the Defense Logistics Agency-Aviation in Richmond, Virginia.

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15. SUBJECT TERMS: Global Supply Chain Forum, Supply Chain Management, Process Implementation, Empirical Validation, Customer Service Management, Demand Management, Order Fulfillment, Competitive Advantage, Organizational Performance				
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